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Original Article

Indian J Pediatr 1995; 62 : 545–555;

# Towards the Elimination of Iodine Deficiency Disorders in India

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**Abstract.** Iodine deficiency disorders (IDD) are an important public health problem in India with an estimated 270 million people at risk of IDD. India has adopted the strategy of salt iodisation for control of IDD and has the goal of "Universal iodisation of salt by 1995 and elimination of IDD by 2000". There is a high degree of political commitment which need to continue if the goal is to be achieved. Currently the ban on ale of uniodised salt is only applicable to salt on human consumption. There is a need for extending the ban to include salt for animal consumption as IDD affects livestock as well. India has the installed capacity to produce its requirement of 5 million tonnes iodised salt. Communication strategies have to be strengthened especially to educate people who have concerns about of iodine toxicity. The success to a large extent depends on the quality control and monitoring of iodine content of salt at all stages from production to consumption. NGO's and the community have to be encouraged to participate in this process. To sustain the elimination of IDD, a partnership of various stakeholders IDD elimination is essential. **(Indian J Pediatr 1995; 62 : 545-554)**

**Key words :** *Iodine deficiency disorders; Lamination; India*

This paper describes the current progress towards the elimination of Iodine Deficiency Disorders (IDD) in India. It is covered under subheadings which trace the path of "assessment - analysis - action - assessment "cycle. Under each subheading, first, the current status is described followed by the agenda for the future. Unlike communicable diseases like smallpox, IDD can not be eradicated once and for ever. The control efforts like salt iodisation will have to be sustained perpetually. The concluding part of the paper raises the issues of sustainability and the partnership that needs to be built between the stakeholders to achieve the sustained elimination of IDD.

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## Assessment of the Problem

### Current status

India is the second most populous country in the world with a population of 834 million (1991 census). High prevalence of goitre and cretinism exists in a broad Himalayan and sub-Himalayan goitre-belt from Jammu and Kashmir in the North to Arunachal Pradesh in the East and along this entire length extending at least 500 kms south of the Himalayas into the flat sub-Himalayan *terai* (plains). In addition to the well-known "Himalayan endemic belt", iodine deficiency has been reported from many other states in the country. In 1989, Indian Council of Medical Research (ICMR) carried out a multicentric IDD prevalence study. Nine states outside the traditional "goitre-belt" were studied for the prevalence of goitre and cretinism. A

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TABLE 1. Status of IDD Endemicity and Ban Notification in States/UTs of India

| State/UT | Status of Ban | Total Dist. | Dist.* surveyed | Dist. endemic | % dist. endemic |
|---|---|---|---|---|---|
| Andhra Pradesh | Full | 23 | 7 | 6 | 85.7 |
| Arunachal Pradesh | Full | 12 | 10 | 10 | 100 |
| A & N Islands* | Full | 2 | 1 | 1 | 100 |
| Assam | Full | 18 | 18 | 18 | 100 |
| Bihar | Full | 38 | 21 | 20 | 95 |
| Delhi | Full | 1 | 1 | 1 | 100 |
| Goa | No ban | 1 | 1 | 1 | 100 |
| Gujarat | Full | 19 | 11 | 9 | 82 |
| Haryana | Full | 14 | 3 | 2 | 67 |
| Himachal Pradesh | Full | 12 | 10 | 10 | 100 |
| Jammu & Kashmir | Full | 15 | 14 | 14 | 100 |
| Karanataka | Partial | 20 | 17 | 5 | 29 |
| Kerala | No ban | 14 | 5 | 4 | 80 |
| Madhya Pradesh | Full | 45 | 16 | 16 | 100 |
| Maharashtra | Partial | 31 | 28 | 10 | 36 |
| Manipur | Full | 8 | 6 | 6 | 100 |
| Meghalaya | Full | 5 | 2 | 2 | 100 |
| Mizoram | Full | 4 | 3 | 3 | 100 |
| Nagland | Full | 7 | 7 | 7 | 100 |
| Orissa | Partial | 13 | 2 | 2 | 100 |
| Punjab | Full | 12 | 3 | 3 | 100 |
| Rajasthan | Full | 27 | 3 | 3 | 100 |
| Sikkim | Full | 4 | 4 | 4 | 100 |
| Tamil Nadu | Full | 21 | 2 | 1 | 50 |
| Tripura | Full | 3 | 3 | 3 | 100 |
| Uttar Pradesh | Full | 62 | 34 | 29 | 85 |
| West Bengal | Full | 18 | 5 | 5 | 100 |
| Chandigarh | Full | 1 | 1 | 1 | 100 |
| Dadra & Nagar Haveli | Full | 1 | 1 | 1 | 100 |
| Daman and Diu | Full | 1 | 1 | 1 | 100 |
| Lakhswadeep | Full | 1 | – | – | – |
| Pondicherry | No ban | 4 | – | – | – |
| Total No. of Dist. | | 457 | 239 | 197 | |

[Source (3)]

* Survey done by Centre for Community Medicine, All India Institute of Medical Sciences, New Delhi.

total of 409, 923 individual were examined and the overall goitre prevalence observed was 21.1 percent, whereas the overall cretinism prevalence was 0.7 percent.[1]

In India, it is estimated that 270 million people are at risk and 79 million are affected by IDD which includes, 2.2 million and 6.6 million with mild neurological disorders.[2] Out of the total 457 districts, 239 districts have been surveyed by the Government of India and State Governments. Of these, 197 districts are endemic for goitre (Table 1). No single state in the country is free from IDD as a public health problem on the basis of these surveys.[3] Thus the strategy for IDD elimination should be applied to the whole country.

The incidence of neonatal hypothyroidism (NH) in a severely endemic area of India (like Uttar Pradesh) is 2400 per 100,000 births which is 50 to 200 times more than the reported average incidence of NH in non-endemic areas. This means that on an average, with every passing hour, 10 children are born in the country who will not attain their optimal mental and physical potential as a result of neonatal hypothyroidism due to environmental iodine deficiency.[4] It has also been observed that the Intelligence Quotient (IQ) of school children in areas with iodine deficiency is about 13 points lower than the children living in iodine sufficient areas.[5] The total IQ points thus lost to the country is formidable.

All this makes India as one of the major endemic iodine deficiency country in the world. Immediate steps are therefore, required to ensure that iodine supplementation, in some form, reaches the population, at the earliest.

## Agenda for future

As there is great variability among the different districts in the country, it may not be right to extrapolate the prevalence rates to the rest of the country. It is essential that all the districts are surveyed at the earliest using epidemiologically sound techniques. The recently recommended use of EPI Cluster sampling technique for this purpose by a consultative committee of WHO/UNICEF/ICCIDD is easy to carry out and can be done in a short span of time.[6] This committee also recommended

TABLE 2. Grading of Goitre by Palpation Method

| Grade | Description |
|---|---|
| 0 | No palpable or visible goitre |
| 1 | A mass in the neck that is consistent with an enlarged thyroid that is *palpable but not visible* when the neck is in the normal position. It moves upward in the neck as the subject swallows. Nodular alteration (s) can occur even when the thyroid is not enlarged. |
| 2 | A swelling in the neck that is *visible when the neck is normal position* and is consistent with an enlarged thyroid when the neck is palpated. |

[Source (6)]

TABLE 3. Summary of IDD Prevalence Indicators and Criteria for a Significant Public Health Problem

| Indicator | Target population | Severity of public health problem (prevalence) Mild | Moderate | Severe |
|---|---|---|---|---|
| Goitre Grade > 0 | SAC* | 5.0-19.9% | 20.0-29.9% | >30.0% |
| Thyroid volume > 97th centile by ultrasound | SAC | 5.0-19.9% | 20.0-29.9% | >30.0% |
| Median urinary iodine level (μg/l) | SAC | 50-99 | 20-49 | < 20 |
| TSH > 5mU/l whole blood | Neonates | 3.0-19.9% | 20.0-39.9% | > 40.0% |
| Median $T_g$ (ng/ml serum) | C/A** | 10.0-19.9 | 20.0-39.9 | > 40.0 |

* SAC = school-age children
** C/A = children and adults
[Sources (6)]

the use of simplified classification of goitre and indicators for assessing the severity of IDD as public health problem. These have been shown in Table 2 and 3 respectively. It is vital that a complete survey of the country is undertaken using this method at the earliest. However, this should not delay the immediate implementation of salt iodisation programme in these areas.

## Strategies Available

### Current status

All the methods of prevention of IDD are based on supplementation of iodine in different ways. This includes fortification of different food stuffs like salt, bread, milk etc. with iodine or use of iodised oil. Of the two most common methods of iodine supplementation - iodized salt and iodized oil injection, the former is widely practised. This was one of the strategy adopted by India when it launched the National Goitre Control Programme (NGCP) in 1962.

### Agenda for future

Though iodised salt is undoubtedly the strategy for the country, there is still a scope for complementary strategy in the form of iodised oil. This should, however, be limited to high endemic areas where there is high prevalence of cretinism. Other factors which further compound the problem in these areas are the distance from the salt producing centres, difficulty in transport and communication due to hilly terrain and annual or semi-annual salt-purchasing habits of people. The state of Sikkim with high prevalence of goitre

(56.9%) and cretinism (2.9%) among school children is one such example.[7] It should, however, be clear that the iodised oil should only be a short term strategy and all efforts to strengthen the supply of iodised salt should be made. Fortification of salt has also been tried for controlling iron deficiency anemia. With the availability of technology for double fortification, it is likely that this strategy may be adopted in the near future. This has important implications for the quality of common salt produced in the country.

## Political Commitment

### Current status

The efforts of the Government of India to achieve universal iodisation have been affirmed at many important national and international events : (i) In May 1990, the 43rd World Health Assembly passed a resolution commending the governments, inter-governmental and non-governmental organisations for their efforts to prevent and control IDD as a major health problem in all the countries by the year 2000. (ii) In September 1990, the historic world summit for children, convened by the United National, adopted a plant of action setting out the goals one of which was "Virtual Elimination of IDD". India was one of the signatories of this summit.[7] (iii) Historically, Goitre and IDD elimination was a part of the 20-point programme of the Prime Minister of India, late Mrs. Gandhi. The adoption of the resolution of International Conference of Nutrition held in 1992 at Rome and the National Nutritional Policy, both of which have reference to IDD by the government in 1993, reflect the strengthening of government's resolve to eliminate IDD. (iv) The commitment of the Government of India to universalize iodisation of salt by 1995 and elimination of IDD by the year 2000 was reflected in the second SAARC Conference on children in South Asia, held in Colombo, Sri Lanka, in September 1992.[8] (v) The National Plan of Action for Children (NPA) of the Government of India also includes "Universal iodisation of salt for reduction of IDD to 10% by 2000".[9]

### Agenda for future

In 1996, A report has to be placed before the World Health Assembly on the progress achieved in the global efforts towards IDD elimination. India can seize this opportunity to move/sponsor the resolution in view of its significant achievements.

## Advocacy

### Current status

Though there has been sufficient political commitment for elimination of IDD in India, there is a need for different national and state level discussions. A meeting of the 'Policy and Advocacy on IDD' was held for high level health officials on 17 January 1994 at Delhi. It was chaired by the Health Secretary and 47 officials from central government, state governments and representatives from national and international agencies participated in the meeting.

### Agenda for future

There is a need to continue the exercise on an ongoing basis as the political and the administrative leadership keeps on changing. The advocacy efforts should focus on the potential aspect for success of this programme among the different national health programmes.

## Legislation

### Current status

The sale of uniodised salt has been banned by issuing notifications under Section 7 (clause iv) of Prevention of Food Adulteration (PFA) Act by the state governments within their territories either fully or partially. The qualities of iodised salt have been specified under the provision of item A.15.01 of Appendix B of PFA Rules, 1954.[2] The ban is applicable only to the salt meant for human consumption and not applicable to salt for animal consumption. Strict ban enforcement is as important and essential as the ban notification. The PFA Act is implemented by Food and Drugs Administration of the concerned states. The food inspectors are empowered to draw samples in accordance with the procedure laid down in the rules and get them analysed in the designated laboratories. If a salt sample fails to meet the specifications, either in terms of iodine content or other characteristics, the food inspectors are empowered to launch prosecutions against the manufacturer/producer/retailer/seller of such substandard iodised salt. A successful prosecution could mean imprisonment which shall not be less than six months, but may be extended upto three years and a fine of not less than Rs. 1000.[2]

The full ban notification has been in force in 21 states and 5 union territories (Table 1). Gujarat and Tamil Nadu have recently issued full ban notification with effect from 1st January 1995. Kerala, Goa, and Pondicherry have not issued any ban notification whereas Karanataka, Maharashtra and Orissa have issued partial ban notification.[2]

### Agenda for future

Necessary efforts to ban uniodised salt in all states and union territories should be made. At present ban is only on salt meant for human consumption and not on salt meant for animal consumption. This implies that both the types of salt are available in the market and the uniodised salt being cheap is more likely to be bought by a not so knowledgeable consumer. Therefore, it is necessary that ban is extended to

Table 4. Criteria for Monitoring Progress Towards Eliminating IDD as a Public Health Problem

| | Indicator | Goal |
|---|---|---|
| 1. | Salt iodisation<br>Proportion of Households consuming effectively iodized salt | > 90% |
| 2. | Urinary iodine<br>Proportion below 100 µg/l<br>Proportion below 50 µg/l | <br>< 50%<br>< 20% |
| 3. | Thyroid size<br>In school children 6-12 years of age :<br>Proportion with enlarged thyroid, by plapation or ultrasound | <br><br>< 5% |
| 4. | Neonatal TSH<br>Proportion with levels > 5mU/l whole blood | <br>< 3% |

[Source (6)]

all salts. It is also important to note that IDD affects livestock as well and causes abortions, still births, decreased yield of meat, milk, egg, wool etc. and a decreased capacity to work.[10]

## Capacity Building/Training

### Current stuatus

All India Institute of Medical Sciences, National institute of Communicable disease at New Delhi and All India Institute of Hygiene and Public Health at Calcutta have been identified as nodal training centres for both medical and non-medical personnels also and.monitoring salt urinary iodine.

### Agenda for future

Training on IDD should also be a part of the general training of the health workers at all state Health and Family Welfare Training Centres. Sufficient emphasis on IDD should also be a part of the medical undergraduates curriculum.

## Issues Related to Salt Iodisation

### Current status

The total annual production of salt in India is 13.5 million tonnes, out of which 5.2 million is used for human and animal consumption and the rest for industrial purposes. The three major salt producing states are Gujarat (68%), Tamil Nadu (15%) and Rajasthan (12%).[2] There area present about 6,450 medium and large scale producers who account for 92% of the total salt produced in the country, the rest 8% being accounted for by about 3,000 small scale producers.[11]

Of the total installed capacity of 6.6 million tonnes of salt iodisation only about 3 million tonnes are being produced. The salt requirement for the country is around 5 million tonnes whereas the rest can be exported. The production and demand for iodised salt can be raised substantially once all the states notify ban of uniodised salt and strictly enforce it.

To facilitate easy and speedier distribution of salt, the Salt Commissioners Office and the Ministry of Railways have developed a railway zonal scheme linking production centres and sources with the nearest distribution points.[2]

### Agenda for future

A good proportion of the salt is produced by medium and small scale producers. They find it difficult and uneconomical to iodise their salt. Designing and production of hand-operated iodistation plants with a capacity to iodise about 100 Kg salt/hour at low cost (Rs. 15,000 per plant) is being developed by an Indian firm. The transportation by road is increasingly being used and a need for proper channelistion of routes is needed.

To prevent iodine losses during storage and transport, there is a need for use of safe and protective packing by HDPE or LDPE bags. In places where buying is annual/semi-annual, one should advocate large LDPE bags rather than small packets. With the increasing concern of environmentalist about the use of plastic bags, there is need for research to look for a biodegradable yet protective material that meets the packaging requirements of consumers.

## Information Education and Communication

### Current status

Television and Radio spots addressing different issues in IDD have been agreed upon and are being broadcast. These materials have been prepared after extensive Knowledge Attitude Practice (KAP) surveys in the affected areas. These messages are primarily aimed at the general public and are meant to create a demand for iodised salt.

As a policy decision in 1989, the Government of India has decided to promote the national logo of "smiling sun" for an easy identification of iodised salt by the public. If properly enforced, this not only ensures a quality product but also gives the public value for their money.

### Agenda for future

There have been repeated concerns about the toxicity of iodised salt and the need for universal iodisation. Issues related to the safety of universal salt iodisation have been carefully examined by WHO which recommends that daily intakes of upto 1mg (1000 µg) appear to be entirely safe.[12] At the current recommended levels in India, the daily intake is likely to be in the range of 150 µg to 300 µg. The benefits to be derived from universal salt iodisation by the affected, and the absence of significant adverse effects among others in the same area who are not iodine deficient, far outweigh any risk of excess intake for a small minority.[12]

IEC efforts aimed at doctors, nutritionists and decision-makers are necessary to remove the misconceptions regarding iodine toxicity. Various professional bodies of doctors, pediatricians, nutritionists, endocrinologists like Indian Medical Association should include this in their agenda.

## Monitoring

### Current status

The success of the National IDD Control Programme depends primarily on the iodine level in salt at the retailer level, and finally at the consumer level. For an effective salt iodisation programme, monitoring the levels of iodine at various stages and under various circumstances in one of the most important factors.

Every iodized salt manufacturer has to maintain a process control laboratory to ensure proper level of iodisation. A second check is carried out by the Salt Department before the dispatch of salt by rail or road.

Quality control at the retail level is done by the State Governments through the Health Directorates. The Food Inspectors of the concerned State Governments maintain the quality of iodized salt. In order to strengthen the monitoring system, Government of India with UNICEF assistance has finalised a project for intensive IDD activities in four endemic states of Assam, Madhya Pradesh, Himachal Pradesh and Uttar Pradesh.

Though the government has a system for monitoring, it is necessary to supplement it by external agencies. Non-governmental organizations (NGOs) have an important role to play in this and its success has been proven by a recent study undertaken in U.P. The study was done in sixteen districts around Dehradun, Gorakhpur and Varanasi. Three NGOs were selected which further identified more peripheral NGOs who collected salt from the households and retailers. It revealed that out of 10,153 salt samples collected, 60.9% of the salt samples had iodine levels below the recommended 15 ppm. The iodine level was especially low in Gorakhpur and Varanasi zones where 72% to 73% of samples had iodine level below 15 ppm compared to 50% in Dehradun. A total of 5.3% salt samples had no iodine.[13]

### Agenda for future

Though the above study proved the feasibility of NGOs' for this purpose, more NGOs in different parts of the country have to take up this challenge. With the availability of spot testing kits monitoring can be done in schools and even the general public can be asked to participate in this activity. The criteria for monitoring progress towards elimination of IDD as a public health problem is given in Table 4.

## Community Participation

### Current status

Modest efforts have been made by some NGOs in this field using their existing network. However, much needs to be done. With the promulgation of *Panchayati Raj* Act, community participation can actually be demonstrated in practice. Madhya Pradesh, which is the first state of the country to implement this Act, has already demonstrated the immense potentiality of this scheme. In conjunction with the high level political commitment, Madhya Pradesh has forged ahead with an action programme to eliminate IDD form the state by 1997.[14]

### Agenda for future

In the continuing process of empowerment of people to take their own decisions, IDD should feature as an important issue. The impact of iodine deficiency on intelligence and educability of children is an important impediment for the development of a community. It also seriously handicaps our efforts for education for all by the end of this century. It is absolutely essential that all the impediments are removed in its path. If necessary the Consumer Forums and NGO's should be encouraged to file Public interest litigation on behalf of cretins and children of India. It is indeed paradoxical that at present some people/organisations are questioning universal salt iodisation.

## Building a Partnership

There are a number of contributors to the successful elimination of IDD. Each will need to understand the potential of other. These stakeholders include government, food processing industry, nutritionists, educationists, agriculture and animal husbandry, communication professionals and people working with mentally disabled. Commitment to and ownership of the solution to the IDD problem by this wider network of stakeholders will be essential to ensure the elimination of IDD by the year 2000.[15]

This agenda of involving and building alliances with a large and diverse range of allies is ambitious but not impossible. The first step in this direction was taken in April 1995 when delegates for six South Asian countries - Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka came together to decide the strategy for the subcontinent.

## Sustainability

As said earlier, unlike the communicable diseases, eliminating IDD is not a one time effort. The main effort is to sustain the achievements. Many countries have suffered setbacks in their programme of IDD elimination, when the success induced a sense of complacency.

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The iodistation of salt, while undoubtedly a simple technique for an immeasurably important social benefit, is, nevertheless, only the first step in the goal of elimination of IDD. Many other steps will be needed before IDD can be prevented from ever making a comeback. The strategy for management of sustained IDD elimination should, therefore, focus on continuous political and financial commitment, clear communication strategy, persistent quality control, regular monitoring and responsive administration.[15]

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世界衛生大會決議
قرارجمعية الصحة العالمية
RESOLUTION OF THE WORLD HEALTH ASSEMBLY
RÉSOLUTION DE L'ASSEMBLÉE MONDIALE DE LA SANTÉ
РЕЗОЛЮЦИЯ ВСЕМИРНОЙ АССАМБЛЕИ ЗДРАВООХРАНЕНИЯ
RESOLUCIÓN DE LA ASAMBLEA MUNDIAL DE LA SALUD

FORTY-NINTH WORLD HEALTH ASSEMBLY WHA49.13

Agenda item 17 25 May 1996

# Prevention and control of iodine deficiency disorders

The Forty-ninth World Health Assembly,

Having considered the report of the Director-General regarding the progress achieved in preventing and controlling iodine deficiency disorders;[1]

Recalling resolutions WHA39.31 and WHA43.2 on the prevention and control of iodine deficiency disorders,

1. COMMENDS governments, international organizations, bilateral agencies, and nongovernmental organizations, in particular the International Council for Control of Iodine Deficiency Disorders:

(1) on their efforts to prevent and control iodine deficiency disorders and to support related national, regional and global initiatives;

(2) on the progress achieved since 1990, through joint activities in many countries, towards the elimination of iodine deficiency disorders as a major public health problem throughout the world;

2. REAFFIRMS the goal of eliminating iodine deficiency disorders as a major public health problem in all countries by the year 2000;

3. URGES Member States:

(1) to give high priority to the prevention and control of iodine deficiency disorders wherever they exist through appropriate nutritional programmes as part of primary health care;

(2) to increase efforts for the sustainability of the elimination of iodine deficiency disorders by continued monitoring, training and technical support, including advice on appropriate health legislation, and social communication in cooperation with the International Council for Control of Iodine Deficiency Disorders, other nongovernmental organizations and UNICEF, as required;

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[1] Document A49/4, part VII.

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4. REQUESTS the Director-General:

(1) to continue to monitor the incidence and prevalence of iodine deficiency disorders;

(2) to reinforce the technical support provided to Member States, on request, for monitoring progress towards the elimination of iodine deficiency disorders with the help of the International Council for Control of Iodine Deficiency Disorders, other nongovernmental organizations and UNICEF, as required;

(3) to mobilize additional technical and financial resources to permit those Member States in which iodine deficiency disorders are still a significant problem, for training health and development workers in the early identification and treatment of iodine deficiency disorders and develop or expand their appropriate public health preventive programmes for the elimination of these disorders;

(4) to establish a mechanism for verifying the elimination of iodine deficiency disorders in the world;

(5) to report to the Health Assembly by 1999 on progress achieved in the elimination of iodine deficiency disorders.

Sixth plenary meeting, 25 May 1996
A49/VR/6

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Special Article Indian J Pediatr 1995; 62 : 381-393

# Review of Experiences with Iodized Oil in National Programmes for Control of Iodine Deficiency Disorders

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Iodine deficiency is a world wide problem that leads to goitre and the syndrome of endemic cretinism together with clinical and subclinical deficits of motor and cognitive function. This spectrum of defects have been collectively labelled as iodine deficiency disorders.[1] About one billion people world wide are at risk for iodine deficiency.[2]

In India, iodine deficiency exists in the Himalayan/sub-Himalayan belt, some 2500 kms in length from Jammu and Kashmir in the west to Arunachal Pradesh in the east, and along this entire length extending at least 500 kms south of Himalayas into the flat sub-Himalayan Terai.[3] In addition iodine deficiency exists in many pockets spread throughout the country.[4,5] Current estimates indicate that, there are 54 million people with goitre, 2.2 million suffer from endemic cretinism and an additional 6.6 million have milder neurological deficit attributable to environmental iodine deficiency.[6] In severely iodine deficient regions of the country, the incidence of neonatal chemical hypothyroidism has been found to be between 7.5% and 13.3%.[7]

There is an overwhelming evidence to indicate that IDD can be effectively prevented by simply providing an adequate intake of iodine. Iodine supplementation is available in several forms. Interventional measures designed to cover an entire population include: iodized salt, iodized oil and iodized water.

There exists a clear choice of strategies for the control of IDD. They are complementary to each other. Probably not all strategies will be appropriate for all conditions. Some will be more relevant than others in a given situation. In some, a combination of strategies may appear advisable.

In India, iodized oil was used in a pilot study in Uttar Pradesh. Although the results were encouraging, on the basis of (unpublished) observations in a subset of recipients of iodized oil, concern has been expressed over the theoretical possibility that iodine supplementation during pregnancy may adversely affect foetal development as a result of maternal thyroid inhibition from Wolff-Chaikoff effect. This led to a set back to the IDD control programme in the country. It is with this background a

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in the treated group (children whose mothers had received iodized oil) 7 of 412 children (1.7%) were cretins (p<0.001). It is notable that of the mothers of cretinous children, 6 of 7 mothers in the treated group were already pregnant at the time of injections. Therefore, of the children conceived after their mothers were injected only one cretin was born of the treated group. The study, therefore, concluded that iodized oil is effective in preventing endemic cretinism provided it is given prior to conception. Children born into the trial between 1966 and 1972 were followed up until 1982.

The follow up of children born into the trial population was limited to five villages for logistic reasons, and the cohort of children born into the trial were further examined in 1974, 1976, 1978 and 1982.[15,16] Several measures of motor and cognitive functions were studied. In 1978, when the children were aged 6-12 years, the tests applied were of grip strength, speed of movement (by tapping or dotting with a pencil), unimanual accuracy (by screwing nuts onto bolts or by inserting pegs into a pegboard), and bimanual accuracy by bead threading. The iodine-supplemented group performed significantly better on the tasks of uni and bimanual accuracy, but the scores on the other tasks did not differ significantly. In 1982, when the children were aged 10-12 years, the pegboard and bead-threading tests were repeated and the intellectual performance was assessed by Pacific Design Construction Test (PDCT). The results showed that, a greater proportion of children in the control than in the supplemented group performed poorly.

A field trial of iodized oil was initiated in few villages of Andean Ecuador in 1966. The recipients of iodized oil injections have been followed most carefully upto the present time-1992.[17,18,19] In the two villages studied, the mean urinary iodine excretion was below 20 ug/gm of creatinine. Prior to intervention, the overall prevalence of goitre was between 50% and 70%, and from 6% to 8% of the subjects were cretins. Administration of intramuscular iodized oil in one dose lead to a goitre reduction of 36% within 2 years, a decrease of the 24 hour radio iodine uptake from 79% to 38%, and increase in the serum PBI from 2.8 to 7.1, and an increase in the urinary iodine excretion to 87 ug/gm of creatinine. The only toxic effect of oil administration was the identification of three subjects with thyrotoxicosis a few months following oil administration. They were identified in the follow up. A particularly salutary effect of this programme was improvement of the long term performance of the children born of mothers who received iodized oil. Improvement was measured in terms of school attainments and in results of neuromotor and psychological testing.[20,21] No cretin was identified among the progeny of iodized oil recipients.

In Peru, a trial of iodized oil prophylaxis was started in 1966 by Pretell *et al.*[22,23] They showed that 18 months after iodized oil injection the prevalence of grade I goitre fell from 58% to 16%. No hypothyroidism or Jod-Basedow was encountered. This study also showed that thyroxine levels of pregnant women under prophylaxis improved and adequate quantity of iodine were present in breast milk of lactating mothers who had received iodized oil.

In the severely endemic region of Zaire in Central Africa, iodized oil injection programme was begun in early 1970s and has continued much more extensively in the Ubangi region where severe iodine deficiency has existed. Two longitudinal studies from this region are important as they address the efficacy of iodized oil and its safety in pregnancy. In the first trial[24] the short and long term effects of iodized oil was investigated. In a village of 1181, the subjects were injected with iodized oil, goiter prevalence fell dramatically from 48% before treatment to 16% one year later; remained at this level after 2.5 years, then increased to 26%, five years after iodized oil. The daily urinary iodine which was 15 ug/day was accompanied by high thyroidal uptake and serum TSH. Eighteen months after the injection of iodized oil, the daily urinary iodine excretion was 640 ug/day. The thyroidal uptake and serum TSH were low. Even five years after the injection of iodized oil, the serum thyroxine was well within the normal range. Along with this study, 2000 inhabitants of two villages treated with iodized oil were followed up and no case of Jod-Basedow was observed.[24,25,26]

The second study was conducted in the Ubangi region in north western Zaire.[24] It was a hospital based randomized trial with concurrent controls. Iodized oil injections were given to women attending antenatal clinic. Prenatal consultations took place between the 20th and 36th weeks of pregnancy. Immediately after the prenatal consultation, one women out of every two, selected randomly in a double blind design, received iodized oil or saline. The outcome measures were birth weight, perinatal and infant mortality rates and development quotient. Outcome assessment was blind. The results obtained from the untreated mothers (control group) and newborns were compared with those obtained from treated group (iodized oil group). The results are shown in Table 2. In the treated group improvement in all the parameters studied were observed. Mean birth weight was 200 grams higher. Perinatal mortality was down to almost half the value in the treated group, while infant mortality was 25% and 17% respectively. No goitre was observed in the newborns of treated mothers, who had a mean daily iodine excretion of 576 ug/day at delivery. The psychomotor development quotient in infants, 4 to 25 months of age was 104 in the untreated group and 115 in the treated one. The differences were statistically significant.

The other most important observation of this Ubangi study was the observation of serum T-4 concentration in children born into the trial. In the untreated group there was extreme variability and very low serum T-4 values and they were maintained throughout the study period. In the

TABLE 2. Effect of Injection of Iodized Oil Given During Pregnancy

| | Not treated | Treated |
|---|---|---|
| Birth weight | 2634 +/- 552 (98) | 2837 +/- 542 (112) |
| Perinatal mortality/1000 | 188 (123) | 98 (129) |
| Infant mortality/1000 | 250 (263) | 167 (252) |
| Development quotient | 104 +/- 24 (66) | 115 +/- 16 (72) |

Number of subjects in parentheses

untreated group the mothers iodine deficiency was matched by a low mean value for cord serum thyroxine in the new born and by definitely elevated serum TSH. These findings indicated very high frequency of severe infantile hypothyroidism in the untreated group. In the children born of treated mothers from birth to two years, there was only one unexplained but definite case of both biological and clinical hypothyroidism out of 132 children. In the age period from two to four years, there was a gradual decrease in individual T-4 values and above 4 years of age, the frequency distribution of T-4 values was back to the severely low levels observed in the untreated group. The result of this work show that the injection of pregnant women with iodized oil, is an emergency measure that dramatically prevents thyroid failure, improve the somatic and intellectual development and the very survival of neonates born to mothers treated during pregnancy.

Watanabe et al[27] compared the results of iodized oil by the oral and parental routes in two districts of Western-Argentina. Their results show satisfactory reduction in goitre size by both the routes. Serum thyroxine concentration and thyroidal radioactive iodine uptake were found normal after two years (both routes). Among 250 in one province who received iodized oil, three developed Jod-Basedow. All these three had large nodular goitres.

Maberly et al[28] studied the effect of iodized oil on goitre size, thyroid function and the development of Jod-Basedow phenomenon in the Lobuk Antu district of Sarawak, Malaysia. 240 subjects were studied before and at intervals of one and two years following iodized oil injection. After one year, the goitre prevalence decreased from 75 to 33%. There was normalization of thyroid function. Of the 240 subjects studied, eight were suspected clinically of being thyrotoxic and the diagnosis was confirmed in four subjects by biochemical assessment. Two of these four were 50 years of age and older which is the predicated age of Jod-Basedow.[29,30]

In a longitudinal study in Western Sudan,[31] 2316 school children received single dose of 400 mg of iodized oil in capsule and 1161 children received 1 ml of oil as injection; 2393 children served as controls. One year after treatment, goitre prevalence was reduced from 67% to 36% among children who received iodized oil orally, and from 71 to 42% in those who received it as injection. The goitre prevalence in the control group did not change. Urinary iodine levels increased after iodized oil and remained significantly higher than the initial values during the trial. TSH and the thyroid hormone levels normalized. During the trial iodized oil was also given to 841 individuals covering a wider age range with comparable results. Similar results were obtained in a previous study from Sudan.[32]

A community based controlled trial comparing the oral and intramuscular iodized oil has been carried out in 23 severely iodine deficient villages in Eastern Zaire.[33] All adults in these villages were divided into five groups including a placebo group. The effectiveness was assessed by size of goitre and thyroxine concentration. Iodized oil produced large and statistically significant rise in thyroxine levels at four and eight months after supplementation and the effectiveness of oral iodized oil was comparable to intramuscular preparation. The study also showed yearly administration of iodized oil would be effective in correcting iodine deficiency in communities and that large scale supplementation with oral iodized oil was feasible in remote areas with untrained people.

A follow up[34] of the recipients of iodized oil showed that blood spot thyroxine remained normal throughout the period of two years follow up. The other most important finding was that thyroxine levels in the infants born to mothers treated injection or oral iodized oil were higher than that observed in the control group. TSH levels were not raised in any of the infants in the group who had received iodized oil injection but was observed in one of 87 infants in the orally treated group. Tonglet et al[35] have reported on the efficacy of low doses of iodized oil in the control of iodine deficiency. This trial from Zaire demonstrated that oral administration of one small dose of iodized oil (0.1 ml or 0.25 ml) can correct severe iodine deficiency for about one year. The efficacy of the intervention was demonstrated by the normalization of serum thyroxine and TSH concentrations and reduction in goitre size in the subjects who received oil.

Watcher et al[36] in Southern Highlands of Tanzania have shown beneficial effects of iodized oil injection on thyroid function in children. This study also noted that mothers who received iodized oil injection during pregnancy had sufficient iodine in breast milk for upto three years.

In Nepal iodized salt programme was initiated in 1973 and a mass iodized oil injection programme was initiated in 1979. The impact of the programme was assessed between May 1985 and June 1986. A total of 33,808 individuals were examined for various indicators of IDD in 15 districts. There were seven districts which had been covered by iodized oil and three which were under iodized salt programme. A total of 3,894 children between 5-14 years were examined in the oil intervention districts. There were six cretins in this age group. Similarly a total of 8,158 children were examined in seven other districts and 20 cretins were found. Urinary iodine excretion was higher in the iodized oil recipients and the thyroid hormone concentration was also found to have normalized in the recipients.

In India the efficacy of iodized oil was studied in a pilot study in some PHCs of Deoria and Gonda districts of Uttar Pradesh in 1983.[37] Children and women in the reproductive age group including pregnant women were the major target population. One ml of Lipiodol was given intramuscularly. A total of over 12,000 injections were given. Follow up studies of a sub-set of these groups showed that majority of injected subjects excreted satisfactory levels of urinary iodine upto 45 months post-injection. The breast milk iodine content in mothers who received iodized oil during pregnancy was upto four folds higher than non-injected control mothers from the same area. No untoward results of this programme was noted, except that attention was called to the fact that iodized oil given in the last trimester of pregnancy does not reduce the incidence of neonatal hypothyroidism.[37]

A total of 154 babies born to mothers who had received iodized oil during pregnancy were studied for their cord blood thyroxine and TSH levels. Sixteen of these newborns had neonatal hypothyroidism (16/154). The mean duration before delivery when iodized oil injection was given to these women was 3.5 weeks. It is pertinent to point out that a study from the same region had revealed the incidence of neonatal chemical hypothyroidism to range from 4% to 14%. This indicates that the incidence of neonatal chemical hypothyroidism does not change if iodized oil is given in the last month of pregnancy. However the authors have concluded that iodized oil injection given during pregnancy is harmful and causes neonatal chemical hypothyroidism.

### Safety of Iodized Oil

In the context of National Iodine Supplementation programmes concern has been expressed over the theoretical possibility of two adverse effects of large doses of iodine to whole population, viz., (a) iodine induced hyperthyroidism or Jod-Basedow; (b) Wolff-Chaikoff effect.

Thyrotoxicosis is a rare complication of prophylactic programmes both with iodized salt and oil. Jod-Basedow has been described in different studies including three among 960 subjects in Ecuador,[38] one among 2025 in Peru,[39] three among 94 in Argentina,[27] and four among 240 in Sarawak.[28] Many of these cases were observed in elderly women with multinodular goitre and all were either transient or easily treated. Jod-Basedow has ben extremely rare or non-existent in the several million injections given in several endemias.[40] It is possible that reported cases of Jod-Basedow reflect pre-existing underlying thyroid disease, rather than new pathology. However, epidemiologial surveillance is recommended three to six months after iodized oil injections programmes.

Another concern with iodized oil and that is potentially more important is the theoretical possibility that administration of iodine during pregnancy may affect foetal neurological development if it leads to maternal thyroid inhibition by the Wolff-Chaikoff effect. This fear may be allayed by the data available from many endemias on the beneficial effects of iodized oil given to pregnant women. Pharoah et al have clearly shown the safety of iodized oil administration in pregnancy by following up children born to these women who received iodized oil during pregnancy for fifteen years. Thilly et al have demonstrated in a study of very strict design, that in the neonates born to women who have received iodized oil, complete thyroid function normalization goes hand in hand with a remarkable decrease in perinatal mortality as well as an increase in the birth weights and the somatic and intellectual development of the children. These studies have demonstrated that the injection of pregnant women with iodized oil rather than having adverse effects is an emergency measure that dramatically prevents thyroid failure in the foetuses, with its consequences on brain maturation and perinatal mortality for a period of 2 to 4 years. No case of iodide goitre has been described following injection of iodized oil to women of child bearing age.

On the contrary the data from India[37] showed that iodized oil when given to pregnant women, 3.5 weeks prior to delivery did not decrease the incidence of neonatal hypothyroidism. But unfortunately this data has been mispresented to show that iodized oil has no role in IDD prophylaxis.[41] The results and interpretation of the said study are questionable. Many possible confounders have been carefully concealed. Birth weight and maturity of the infants with neonatal hypothyroidism is not given. The absence of neonatal goitre in any of these 16 infants goes against the theory that the neonatal hypothyroidism in them was due to Wolff-Chaikoff effect. There is no follow up reported. It is well known that the incidence of transient neonatal hypothyroidism is high in the iodine deficient regions.

It is pertinent to point out that Wolff-Chaikoff effect was demonstrated in iodine deficient rats; that a similar inhibition of thyroid gland follow iodine administration to an iodine deficient human population has not been demonstrated.[42] A recent well designed study from China[43] has clearly shown that upto the end of the second trimester, iodine treatment protects the fetal brain from the effects of iodine deficiency. Treatment later in pregnancy or after delivery may improve brain growth and developmental achievement slightly, but it does not improve neurologic status. One of the important observation in this study was that there was no harm to the foetus from large doses of iodine late in the third trimester.

Iodized oil given to pregnant women also increases the breast milk iodine content which is a distinct advantage in many endemias in the under developed world where infants are by and large on breast milk for most of their infancy. It has been suggested that the inability of iodized oil injection given in pregnancy to prevent cretinism is a total contra-indication to its use.[41] This ignores the benefit to the whole iodine deficient population, only some of whom are pregnant.

On the balance of risk between on the one hand very rare cases of iodide goitre in the new born together with Jod-Basedow in the eldest adults and on the other hand the clear evidence that maternal iodine deficiency may severely compromise the development of the foetus, it is quite clear that the iodized oil prophylaxis has a highly advantageous benefit to risk ratio.

**Table 3.** World Experience with Iodized Oil (million doses)

| Continent | Beneficiary population | | |
|---|---|---|---|
| | Oral | Intramuscular | Total |
| Asia | 16.05 | 41.98 | 58.03 |
| Africa | 1.05 | 1.80 | 3.30 |
| Latin America | 1.50 | 0.80 | 2.30 |
| Total | 19.05 | 44.58 | 63.63 |

## Use of Iodized Oil in National IDD Control Programmes

Iodized oil has a definite place in a public health programme for the correction of severe iodine deficiency and prevention of cretinism. The greatest advantage with iodized oil is that iodine supplementation can begin almost immediately. This will provide iodine to the high risk population for two to five years while organising more complicated schemes of salt iodization. This is most important in circumstances where salt iodization is delayed due to various factors such as remoteness of a region and difficulties in a market situation.

It is for this reason that iodized oil has been used on massive scale in many countries and has been found to be extremely satisfactory. In excess of 60 million doses have been given since the original introduction in Papua New Guinea, Table 3. In Asia alone more than 50 million doses have been given (Indonesia-11.4 million doses; China-37 million doses; Nepal-4 million doses).

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### IDD Elimination in India

The National Goitre Control Programme was launched in 1962, with iodized salt as the preferred approach for IDD elimination. After three decades of the programme IDD continues to be a major public health problem for the country. IDD is a classic example of "place disease". There is a striking difference in the prevalence of IDD in different regions of the country. The severe goitre endemias are all in the Himalayan and sub-Himalayan regions. In these regions iodized oil is the preferred approach until iodized salt successfully covers these regions. The long term solution should still be iodized salt. Iodized oil and salt programmes are not mutually exclusive. They are complimentary to each other. In many countries a combined strategy with iodized oil and iodized salt has been successfully used; Indonesia, China and Nepal are few examples from our region.

There is little justification at this stage of development and technical know-how to withhold iodized oil, an effective intervention, from hyperendemic areas and thus deny the benefits of science to the poor. Amongst the objections put forth are cost, spread of infection (HIV) and unapproachability. The cost of iodized oil intervention is important. However, a recent comprehensive analysis done by Pandav et al on "Economic evaluation of iodine deficiency disorder control programme in Sikkim" has demonstrated the cost effectiveness of iodized oil intervention for the "high risk" population covering women in reproductive age group (15 to 44 years) and children under 15 years of age. The incremental analysis showed iodized oil programme as a more efficient alternative producing the following results over iodised salt programme: Rs. 1600 per case averted of endemic cretinism, Rs. 500 per case averted of mild IDD, and Rs. 600 per IDD attributable death averted. The cost benefit ratio of IDD control in this study, which is a conservative estimate (for it did not include benefits as a result of improved educability and benefits to live stock) was also found to be favourable at 1 : 3.[44] In this context, the attempts of Indian scientists to produce iodized oil indigenously using sun flower oil are quite relevant[45] and needs immediate consideration.

The question of outreach is common to all public health programmes, be it infection control or prevention of malnutrition. Given the experience of country's health and welfare departments in the implementation of vitamin A (frequency of administration—6 monthly) and UIP (frequency of contact-monthly), the programme of iodized oil administration; oral-frequency once in two years and injection—once in five years; should pose minimal operational difficulties.

Any public health intervention has its own risks and benefits and the applicability of the said intervention depends on the benefits accrued over the risks. Needle transmitted is a risk in any programme where injection programmes are used. but it has to be weighed against the benefits. In UIP (universal immunization programme) children below one year are given five injections (BCG, DPT x 3 and Measles). Total of 3 per cent of the population of the country are below one year of age which means there are nearly 25 million infants in our country. Assuming a UIP coverage of 80 per cent, hundred million injections are given in the UIP for primary vaccination alone. Can we do away with this on the theoretical possibility of needle transmitted infections? The right step is to take adequate precautions to ensure strict aseptic and sterilization procedures.

There is an urgent need for the nutrition scientists and health planners of the country to give a serious thought to the iodized oil programme as a complementary measure to the iodised salt programme in hyper-endemic areas to halt the relentless march of the physically crippled and mentally retarded children into our society.

The total population of the states of Jammu and Kashmir, Himachal Pradesh, Uttar Pradesh, Madhya Pradesh, Bihar, West Bengal, and the eight North Eastern States is 378 million (1991 census). All these states are in the severely iodine deficient zone. Assuming a conservating estimate of 30 per cent of the population in the states of UP, MP and Bihar to have severe iodine deficiency and the entire population in the states of Jammu and Kashmir, Himachal Pradesh, West Bengal and North Eastern states to have severe iodine deficiency then together approximately 200 million people live in severe iodine deficient areas. The crude birth rate is 30 per thousand, which means 6 million children are born in the regions with severe iodine deficiency in these states every year. Let us assume the incidence of neonatal chemical hypothyroidism (NCH) in these severely iodine deficient regions as 7% (reported incidence of NCH in UP is 7% to 13%). Therefore, 4,20,000 children with NCH are born in these states alone every year. These children are being denied the opportunity to obtain the optimum mental and physical development and yet all this is totally preventable. The picture is similar in many of the developing countries in the world. All that is required is to bridge the gap between a policy based on scientific knowledge and its immediate application in these severely iodine deficient areas.

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DIS 9-3

WHO/NUT/94.4
Distr.: General
Original: English

# IODINE AND HEALTH

## eliminating iodine deficiency disorders safely through salt iodization

A statement by the World Health Organization

World Health Organization
Geneva
August 1994

RN

LO5
18/9/96

The World Health Organization
gratefully acknowledges the financial support
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# IODINE AND HEALTH

## eliminating iodine deficiency disorders safely through salt iodization

A deficiency of iodine, which is among the body's essential trace elements, is both easy and inexpensive to prevent. Iodine deficiency nevertheless continues to be a significant public health problem in many countries. Iodine deficiency not only causes goitre; it may also result in irreversible brain damage in the fetus and infant, and retarded psychomotor development in the child. Iodine deficiency is the most common cause of *preventable* mental retardation. It also affects reproductive functions and impedes children's learning ability. The cumulative consequences in iodine-deficient populations spell diminished performance for the entire economy of affected nations.

Iodine deficiency disorders (IDD) are currently a significant public health problem in 118 countries (1). An estimated 1571 million people worldwide live in iodine-deficient environments and are thus at risk of IDD; 20 million of these are believed to be significantly mentally handicapped as a result. A large proportion of the severely deficient are women in their reproductive years whose babies are at high risk of irreversible mental retardation unless they receive adequate amounts of iodine.

In the last 50 years, many countries in the Americas, Asia, Europe and Oceania have successfully eliminated IDD, or made substantial progress in their control, largely as a result of salt iodization with potassium iodide or potassium iodate and through dietary diversification. For example, in Switzerland, where salt iodization began in 1922, cretinism has been eliminated and goitre has disappeared, while there has been negligible evidence of any adverse effects from iodine intake.

Universal salt iodization[a] has been endorsed in numerous international forums[b] by heads of state, senior government officials, and representatives of international intergovernmental and nongovernmental organizations. Nevertheless, WHO continues to receive queries from national

[a] Universal salt iodization is defined as fortification of all salt for human and animal consumption.

[b] The most important of these are the World Health Assembly, in resolutions WHA39.31 (1986) and WHA43.2 (1990), the World Summit for Children (New York, 1990), the Policy Conference on Ending Hidden Hunger (Montreal, 1991), and the International Conference on Nutrition (Rome, 1992)

health authorities and others seeking reassurance about the safety of providing iodized salt to non-deficient populations. As with all preventive public health measures, the decision to ensure universal salt iodization will be made by weighing the potential risk of excess intake for the few (see pages 3–5) against the well-documented risk of mental and physiological impairment for the many if a deficiency is uncorrected.

In response to concerns expressed, and to facilitate decision-making in countries, this statement summarizes the cumulative scientific and epidemiological evidence in this regard.

## Physiological need for iodine

Based on studies of balance and excretion over a 24-hour period, a safe daily intake of iodine has been estimated to be between a minimum of 50 μg and a maximum of at least 1000 μg (2, 3). A generally accepted desirable adult intake is 100–300 μg/day. At all intake levels, a proportionate amount of iodine is excreted in the urine, which is the biochemical basis for assessing iodine status(4).

## Usual food sources of iodine

Sea fish, other sea food, and seaweed are rich sources of iodine suitable for human consumption. Iodine is also found in vegetables grown in soils containing adequate amounts of this trace element, and in milk products, eggs, poultry and meat from animals whose diet contained sufficient iodine.

## Usual salt intakes

Average daily salt intakes vary from country to country. Usually, consumption levels are within the 5–15 g/day range for children and adults. No increase in salt consumption is called for. Rather, the recommended level of salt iodization should be adjusted to provide approximately 150 μg of iodine/day actually consumed, taking into account usual climatic factors like heat and humidity, which can affect retention of this element. The recommended quantities of iodate to be added to salt under different conditions are provided in Table 1(5). Although potassium iodide was first used in salt iodization, the use of iodate is now recommended since it is more stable than iodide under varying climatic conditions. Because iodate, on ingestion, is very rapidly reduced to iodide, its use in iodinated salt is equivalent to iodide.

*Table 1:* **ICCIDD-UNICEF-WHO recommended levels of iodine in salt**

Examples of desirable average levels at various points in the salt distribution chain, depending on climate, salt intake, and conditions affecting packaging and distribution

Parts of iodine per million parts of salt, i.e. micrograms per gram, milligrams per kilogram or grams per tonne

| *Climate and daily salt consumption (g/person)* | *Requirement at factory **outside** the country* | | *Requirement at factory **inside** the country* | | *Requirement at retail sale (shop/market)* | | *Requirement at household level* |
|---|---|---|---|---|---|---|---|
| | Packaging | | | | | | |
| | Bulk (sack) | Retail pack (< 2 kg) | Bulk (sack) | Retail pack (<2 kg) | Bulk (sack) | Retail pack (< 2 kg) | |
| ***Warm moist*** | | | | | | | |
| 5 g | 100 | 80 | 90 | 70 | 80 | 60 | 50 |
| 10 g | 50 | 40 | 45 | 35 | 40 | 30 | 25 |
| ***Warm dry or cool moist*** | | | | | | | |
| 5 g | 90 | 70 | 80 | 60 | 70 | 50 | 45 |
| 10 g | 45 | 35 | 40 | 30 | 35 | 25 | 22.5 |
| ***Cool dry*** | | | | | | | |
| 5 g | 80 | 60 | 70 | 50 | 60 | 45 | 40 |
| 10 g | 40 | 30 | 35 | 25 | 30 | 22.5 | 20 |

Source: Adapted from *World Summit for Children – mid-decade goal: iodine deficiency disorders.* Geneva, 1994. UNICEF-WHO Joint Committee on Health Policy, document JCHPSS/94/2.7 and reference 5.

N.B. 168.6 mg of $KIO_3$ contains 100 mg of iodine.
N.B. These are indicative initial levels, which should be adjusted in the light of urinary iodine measurement.

## Adverse effects associated with high nutritional intakes of iodine

Since iodine, when ingested in large amounts, is easily excreted through the kidneys into the urine, iodine intakes even at very high levels (milligram amounts) can be consumed safely. However, the following adverse affects, though rare, have been reported.

***Allergic reactions to iodine in food.*** Skin rashes and acne have occasionally been attributed to iodized salt. Such reports are extremely rare, however, and thus these conditions are unlikely to occur following salt iodization. For example, among 20 000 children in the USA suffering from allergy during the period 1935–1974, not a single case was reported of allergic hypersensitivity to iodine in food. Following publication in *Annals of Allergy* of a request for notification of allergy to iodine, not a single report was recorded between 1974 and 1980 (3).

***High intakes of dietary iodine and thyroid diseases.*** Through adaptive mechanisms, normal people exposed to excess iodine remain euthyroid and free of goitre. In certain susceptible individuals, iodide goitre and Hashimoto thyroiditis with hypothyroidism have been observed after iodine intakes of 500–3000 μg/day. The prevalence of susceptible individuals in different countries is not fully known. It has been suggested that high nutritional intake of iodine substantiated by urinary iodine of 1000–10 000 μg/litre—as observed in one country in up to 2% of the population—could have an adverse effect in susceptible individuals and in patients with pre-existing abnormalities of the thyroid gland (3). In this small proportion of the population, chronic excess intake might contribute to the development of Hashimoto thyroiditis, iodide and colloid goitre, and thyroid carcinoma. However, the incidence of follicular thyroid cancer, a more severe form of cancer, is lower in iodine-sufficient than in iodine-deficient areas. There is little indication that iodine in the amounts noted influences the development of any of these thyroid diseases.

In Japan, where dietary iodine intakes are high, it has been shown that:

- normal people who are not iodine-deficient can maintain normal thyroid function states even at intakes of several milligrams of dietary iodine/day;
- the incidence of non-toxic diffuse goitre and toxic nodular goitre is markedly decreased by high dietary iodine intake;
- the incidence of Graves disease and Hashimoto disease does not appear to be affected by high intakes of dietary iodine.

However, high intakes of dietary iodine may induce hypothyroidism in auto-immune thyroid diseases and may inhibit the effects of thionamide drugs (6).

There are well-documented reports of iodine-induced hyperthyroidism (Jod–Basedow phenomenon) where iodine, sometimes in normal quantities, was introduced among iodine-deficient populations. Administration of ordinary amounts of iodine has also been reported to induce hyperthyroidism in people with nodular thyroids, and in other individuals who have no apparent underlying thyroid disease. However, these are transient phenomena, which cease after correction of iodine deficiency; they do not occur in populations with sufficient (i.e. normal) iodine intake.

Current estimates of daily iodine intakes in Canada and the USA are substantially above physiological need—in the range of 460 μg/day among 9–16-year-old children, to greater than 1 mg among as many as 10–20% of adults (7). With a level of iodization that provides these populations approximately 260 μg/day of iodine from salt, it is thus apparent that much of the intake comes from non-salt sources (see below). A survey conducted in 1968–1970 in ten states (USA) showed that where total goitre prevalence was greater than 3.5%, the percentage of individuals with high iodine-excretion values, i.e. more than 800 μg/litre, was 16% compared with 6% in states with lower total goitre prevalence (8).

## Other sources of iodine

In industrialized countries there are many adventitious sources of iodine which increase daily intake levels far above the physiological amount provided through iodized salt, for example (3):

- poultry and eggs from animals that consume fish flour as part of their feed and iodoform in water that is used as a disinfectant;
- cow's milk and dairy products from animals fed seaweed, producing an iodine content of milk as high as 694 μg/litre, or that come into contact with iodophors used to clean milking apparatus or as teat dips and udder washes;
- bread and baked goods through the iodates used as oxidants in dough conditioners and cleaning agents for bakery equipment (reports of the iodine content of bread in the USA range from 0 to 268 μg/slice);

- the iodine-containing colouring agents added to some drugs (including many multivitamins, minerals, and antacids as a coating or colouring agent), beverages, foods (including some brands of dry cereal that contain as much as 850 µg of iodine per 20g of product) and cosmetics.

## Iodine availability

The iodine content of food actually consumed is not necessarily equivalent to that of raw food since some iodine is lost during cooking. For example, losses of about 20% occur in the iodine content of fish by frying or grilling and as much as 58% by boiling. Iodine consumed in food is generally well absorbed, with the possible exception of people suffering from protein–energy malnutrition, which is of particular concern in high-prevalence, endemic-goitre areas of developing countries.

The uptake of radioactive iodine by an individual thyroid is dependent on the amount of stable, i.e. non-radioactive, iodine in the diet. This is the basis for using radioactive iodine to evaluate thyroid function. Studies from Chernobyl following the nuclear reactor accident in 1986 indicate high thyroid cancer rates, especially among young children. It is postulated that the thyroids of children in this iodine-deficient area experienced an unusual uptake of radioactive iodine released into the atmosphere following the accident. It has been estimated that, in general, iodine prophylaxis, e.g. use of iodized salt, should reduce by twofold to threefold the risk of thyroid irradiation resulting from a nuclear accident (9).

## Conclusion

Issues relating to the safety of universal salt iodization have been carefully examined by WHO and by joint FAO/WHO, ICCIDD/UNICEF/WHO and WHO/FAO/IAEA expert groups in the process of preparing recommendations (1, 2, 5, 6). All concerned agree that universal salt iodization is the principal public health measure for eliminating IDD.

Daily iodine intakes of up to 1 mg, i.e. 1000 µg, appear to be entirely safe. Iodization of salt at a level that assures an intake of 150–300 µg/day thus keeps intakes well within a safe daily range for all populations, irrespective of their iodine status. Daily consumption of 10 g of salt containing 50 parts per million of iodine would add a maximum of only 500 µg of iodine. Thus the likelihood of exceeding an iodine intake of 1 mg/day from iodized salt is quite small.

In susceptible individuals—a minority of adults, usually over 45 years of age, who may or may not have nodular goitres—transient side-effects have been reported at usual intakes exceeding 500–3000 µg/day. The benefits to be derived from universal salt iodization by the more than 1500 million people estimated to be at risk or deficient, and the absence of significant adverse effects among others in the same areas who are not iodine-deficient, far outweigh any risk of excess intake for a small minority.

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*Iodine deficiency disorders are both easy and inexpensive to prevent, yet they continue to be a significant public health problem in 118 countries. Despite the endorsement of universal salt iodization in numerous international forums as an effective means of preventing these disorders, queries are still made about the safety of providing iodized salt to non-deficient populations. In response to concerns expressed, and to facilitate decision-making by responsible authorities, this statement summarizes the cumulative evidence in this regard.*

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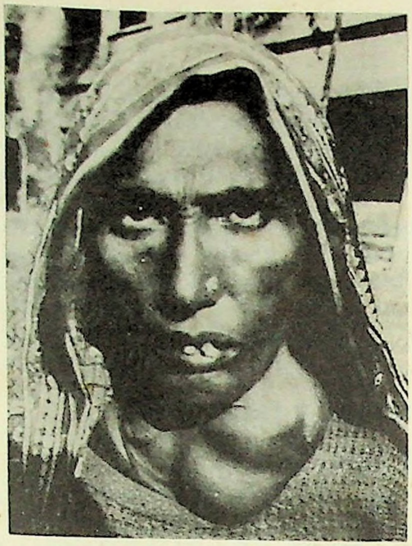
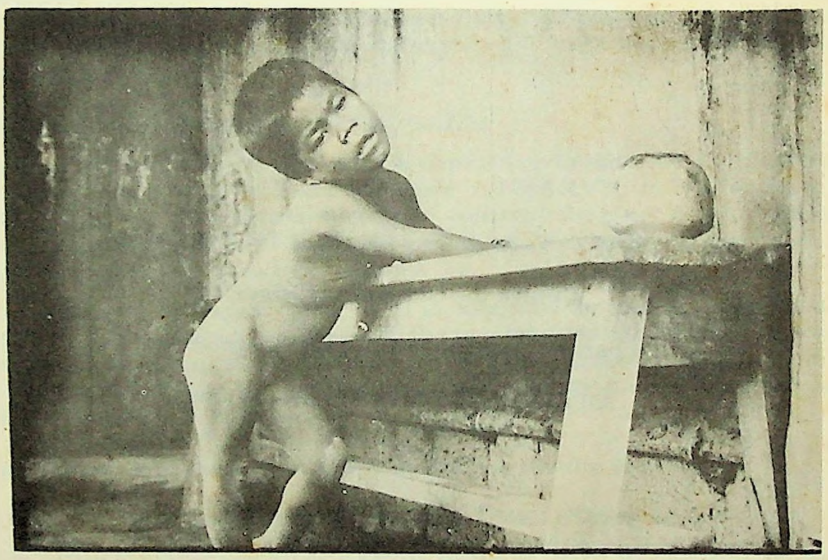


# IODINE DEFICIENCY DISORDERS AND CONTROL MEASURES IN INDIA – CURRENT STATUS



This Public Information Guide is brought to you with the assistance from UNICEF-ROSCA, New Delhi and International Council For Control of Iodine Deficiency Disorders (ICCIDD), South-east Asia Region, New Delhi.

# IODINE DEFICIENCY DISORDERS AND CONTROL MEASURES IN INDIA – CURRENT STATUS

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## ABSTRACT

Goitre has been an age old health problem in the Indian sub-continent. According to the latest available estimate, about 120 million people live in known iodine deficient areas of India of which one-third are goitrous. Environmental iodine deficiency has been established as the dominant cause of endemic goitre in the sub-Himalayan region as well as in several other areas in the interior of the peninsula. A carefully designed prospective study conducted for a period of over 18 years in 100,000 persons of Kangra Valley of Himachal Pradesh has clearly demonstrated the efficacy of iodine fortified common salt in the control of endemic goitre. Subsequent to this study, a National Goitre Control Programme was launched by the Government of India towards the end of Second Five Year Plan, in 1962. In this article the detailed information on goitre prevalence and current status of control measures in different parts of the country is presented.


# IODINE DEFICIENCY DISORDERS AND CONTROL MEASURES IN INDIA – CURRENT STATUS

## INTRODUCTION

Goitre, an age old health problem, has been a subject of public health and scientific interest for over eight decades in the Indian sub-continent. Though its cause was discovered and cure prescribed over two decades back, it still continues to afflict over 40 million people in India and its control still eludes the National Goitre Control Programme. In this communication we briefly review the goitre scene in India and update the current status of control measures in different parts of the country.

## GOITRE – AN AGE OLD HEALTH PROBLEM

Endemic goitre has been an age old health problem in the southern slopes of the Himalaya. Reference to goitre is found in vedic literature 'ATHARVA VEDA' dated to a period around 2000 B.C. 'Galganda' was the name given to goitre by the early Hindu physicians Susruta and Charaka, about 500 B.C.[1] In 'Nidana Sthana' the XIth Chapter of the 'Sushruta Samhita' the definition of 'Galaganda' (Goitre) reads as:

> "The deranged and aggravated Yayu in combination with the deranged and augmented Kapham and fat of the locality affects the two tendons of the neck (Manyas) and gradually gives rise to a swelling about that part of the neck characterised by the specific symptoms of the deranged Doshas (Vayu or Kapham) and principles involved in the case. The swelling is called 'Galganda'" (Goitre)[2]

The term 'Galganda' is used even today in India to denote goitre.

## PREVALENCE OF ENDEMIC GOITRE AND CRETINISM

Though goitre is recognised to be a health problem in the Indian sub-continent for over 2000 years, it still continues to be a major public health problem not only in India but most of the countries of south and south-east Asia. In point of fact, endemic goitre, along with anemia, kwashiorkor, marasmus and xerophthalmia constitute the five principal deficiency diseases in the world today.[3]. In Asia alone, an estimated 436 million people lives in areas with environmental iodine deficiency of which 176 million are goitrous. The countries most affected by endemic goitre and endemic cretinism are India, Pakistan, Nepal, Bhutan, Bangladesh, Burma, Indonesia, China, Phillipines and Vietnam.[4]

Endemic goitre and endemic cretinism are widely prevalent in the Indian sub-continent. The world's most intense endemic belt runs along the slopes, foothills and adjacent plains to the south of the Himalaya, extending over 2,400 kms from Kashmir in the west to the Naga hills in the east. The Himalayan endemic belt involves the northern states of Jammu & Kashmir, Himachal Pradesh, Punjab, Haryana, Uttar Pradesh, Bihar, West Bengal, Sikkim, Assam, Mizoram, Meghalaya, Tripura, Manipur, Nagaland and Arunachal Pradesh.[5]

In addition more and more pockets of goitre are being reported from different parts of the rest of India, now referred to as 'extra-Himalayan' foci of endemic goitre. These include the hilly states of Central India particularly along the Chotta Nagpur Plateau, Sidhi, Shadhol, Sarguja and Raigarh districts in the sub-Vindhya belt of Madhya Pradesh, the Aravali ranges in Rajasthan, along the Narmada valley in Gujarat, the city of Bombay, Aurangabad and Pune distrticts of Maharashtra, some tribal areas of the Visakhapatnam district in Andhra Pradesh, and the tea estates of Kerala. A recent addition to this is the Union Territory of Delhi where the capital of India is located[6]. Thus, endemic goitre has been reported from 16 of the 22 States and 4 of the 9 Union Territories of India (Figure – 1). The range of endemic goitre prevalence varies from 10.2 percent in Ranchi district of Bihar to 69 percent in U.T. of Mizoram with an average goitre prevalence rate of 32 percent.

According to the latest available estimate about 120 million people in India live in know iodine deficiency regions. Of these, the actual number of persons afflicted with goitre is estimated to be about 40 million.[5].

## ETIOLOGY OF ENDEMIC GOITRE

Primacy of environmental iodine deficiency in the causation of Himalayan endemic goitre was first established by a series of investigative efforts, spanning over a decade by Ramalingaswami et al [7,8,9,10,11] . The level of iodine in the drinking water is extremely low in the endemic zone, no value being higher than 3 ugm/L and most values considerably below this figure. Marked elevation of 24 hours thyroidal $^{131}$ I uptake coupled with low urinary iodide excretion of less than 50 micrograms per gram of creatinine clearly demonstrate iodine deficiency state in the goitrous individuals. The plasma inorganic iodine (PII) estimated by the isotope dilution technique was low while PB$^{131}$ I at 48 hours was markedly elevated, thus demonstrating a rapid turnover rate of intrathyroidal iodine pool of these goitrous individuals from the endemic zones.

The glands at histology showed marked acinar proliferation with tall columnar epithelium and scanty colloid, thus substantiating histologically the rapid turnover rate observed indirectly as the elevated PB $^{131}$I. The small intrathyroidal pool is turned over rapidly in an effort to compensate for environmental iodine deficiency, thus maintaining euthyroid state despite the severe environmental iodine deficiency. A majority of the goitrous patients studied showed suppressibility of raised $^{131}$I uptake by extraneous triiodothyronine ($T_3$), thus demonstrating an intact pituitary-thyroid interrelationship. Since most of these goitre, in response to thyroid-stimulating hormone (TSH) did not show any further enhancement of $^{131}$I uptake, maximum endogenous stimulation by TSH is surmised. Studies designed to demonstrate iodine organification defects of partial or complete degrees did not yield any positive results.

## IODINE PROPHYLAXIS: KANGRA VALLEY EXPERIMENT

The efficacy of iodisation of common salt as a prophylactic measure was established early in the century by experiences in the United States of America and Switzerland.[12, 13] In order to substantiate the role of iodine deficiency as the causative factor of endemic goitre in the Himalayan belt and study the effectiveness of iodine prophylaxis, a prospective study was organised in 1954 in a population of approximately 100,000 persons in the Kangra valley of Himachal Pradesh. [8, 11] The study area was divided into three zones, A, B and C. After a baseline survey in 1956, the salt distributed to zones A and C was fortified with potassium iodide and potassium iodate respectively while zone B was supplied with unfortified salt. The salt fortification was such as to supply approximately 200 micrograms of iodine per capita per day. After 6 years of iodisation, i.e., in 1962, a striking decrease in the prevalence of goitre was observable in zones A (from 38 per cent to 19 per cent) and C (from 38 per cent to 15 per cent) when compared to uniodised zone B (from 38 per cent to 40 per cent). Six years later a systematic survey of goitre prevalence showed further reduction in the prevalence rates for zone A and zone C (8.5 percent and 9.1 percent respectively). In 1972, spot checks on goitre prevalence in the iodised areas by an independent group of physicians showed negligible prevalence of goitre among school children and $^{131}$I uptake and urinary excretion of iodide had become normal.

## NATIONAL GOITRE CONTROL PROGRAMME

Subsequent to the classical demonstration of the efficacy of the iodated salt prophylaxis in the control of endemic goitre in the Kangra valley of Himachal Pradesh by Ramalingaswami and associates, a National Goitre Control Programme (N.G.C.P.) was launched by the Government of India towards the end of the Second Five Year Plan, in 1962, to identify the goitre endemic regions of the country and supplement intake of iodine to the entire population of the endemic regions in order to prevent endemic goitre and its grave consequences.[5].

N.G.C.P. has three main components:

(i) Initial survey to identify endemic areas.

(ii) Production and supply of iodised salt to the endemic regions.

(iii) Resurvey in goitre endemic regions after 5 years continuous supply of iodised salt to assess the impact of the control programme.

N.G.C.P. is a purely central plan scheme and entire expenditure incurred in the production of iodised salt is met by the Ministry of Health and Family Welfare (Department of Public Health) which is released as grant-in-aid to the three units currently engaged in manufacturing iodised salt.

The administrative structure of NGCP, is given in Figure 2.[14] As is evident NGCP was conceived to be executed by a multiplicity of agencies comprising of Health, Industry and Railway Ministries of the Central (Federal) Governemnt, Health & Civil Supplies Ministries of the State Governement with State Salt Nominees (private traders) responsible for procurement, transportation and supply of iodated salt to the population living in endemic goitrous regions.

The detailed information on goitre prevalence and control measures in different parts of the country is given in Annexure I.

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Indian J Paediat 51: 53-54, 1984

# RECOMMENDED LEVELS OF SALT IODATION IN INDIA

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A programme of goitre prophylaxis based on iodated salt should aim at providing between 150 and 250 microgram of supplemental iodine per head per day.[1] In India, the average daily consumption of salt per head is 10 gm.[2] Therefore to achieve the above level of supplemental *iodine at consumption,* the salt should have 15 to 25 parts per million (ppm) concentration of *iodine.*

It has been reported from a tropical country that iodated salt stored in stitched plastic bags at room temperature for three months retained upto 75 percent of its iodine. After nine month's storage, the iodine dropped to 50 percent . Experience with salt packed in stitched jute bags has been less satisfactory. In extremely adverse conditions of packaging, storage and handling, the amount of iodine remaining after 9 months may be as little as 10 percent.[3] Assuming that there is 50 percent loss of iodine between production and consumption level, the salt should have 30 to 50 ppm concentration of *iodine* at the *source of production.*

In India, at all the three units of production (Sambhar Lake, Howrah and Khargoda) the salt is fortified with Potassium Iodate ($KIO_3$)[4] Quantitatively 1.685 mg of $KIO_3$ contain 1 mg of *iodine.* Therefore, the concentration of *iodate* in salt, in order to have 30 to 50 ppm of iodine, should be standardized at 51 to 84 ppm, at the *production level.*

There have been reports in the literature about complications of goitre prophylaxis. These have arisen, in the words of David Marine as result of 'abuse of iodine'. Amongst these *rare complications,* the common ones which have been mentioned are allergic reactions to iodide in food, iodine induced hyperthyroidism, iodism and iodine goitre. Iodized salt has often been blamed for skin rashes and acne. Today such reports are extremely rare. From 1935 to 1974, among 20,000 children in United States suffering from allergy, not a single case of allergic hypersensitivity to iodine in the food was reported.[5] A request for notification of allergy to iodine in the Annual Allergy in 1974 has not yet yielded a single report so far.[5] These are reported to occur exclusively in situations where iodine is administered as a therapeutic agent in pharmacological doses (gm) and therefore irrelevant in situations like iodine prophylaxis for goitre, where iodine consumed is in microgram quantity per head per day.

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*Reprinted from :*

***Indian Journal of Pediatrics***

Published Bimonthly at :
**DEPARTMENT OF PEDIATRICS**
ALL-INDIA INSTITUTE OF MEDICAL SCIENCES
NEW DELHI-110 029

This Public Information Guide is brought to you with the assistance from UNICEF-ROSCA, New Delhi and International Council For Control of Iodine Deficiency Disorders (ICCIDD), South-east Asia Region, New Delhi.

## ANNEXURE - 1

## NATIONAL GOITRE CONTROL POGRAMME – CURRENT STATUS

Statement showing baseline survery year and goitre prevalence, year of commencement of Iodated salt supply, year of re-survey and goitre prevalence in endemic districts (D), Union Territories (UT) and state (S).

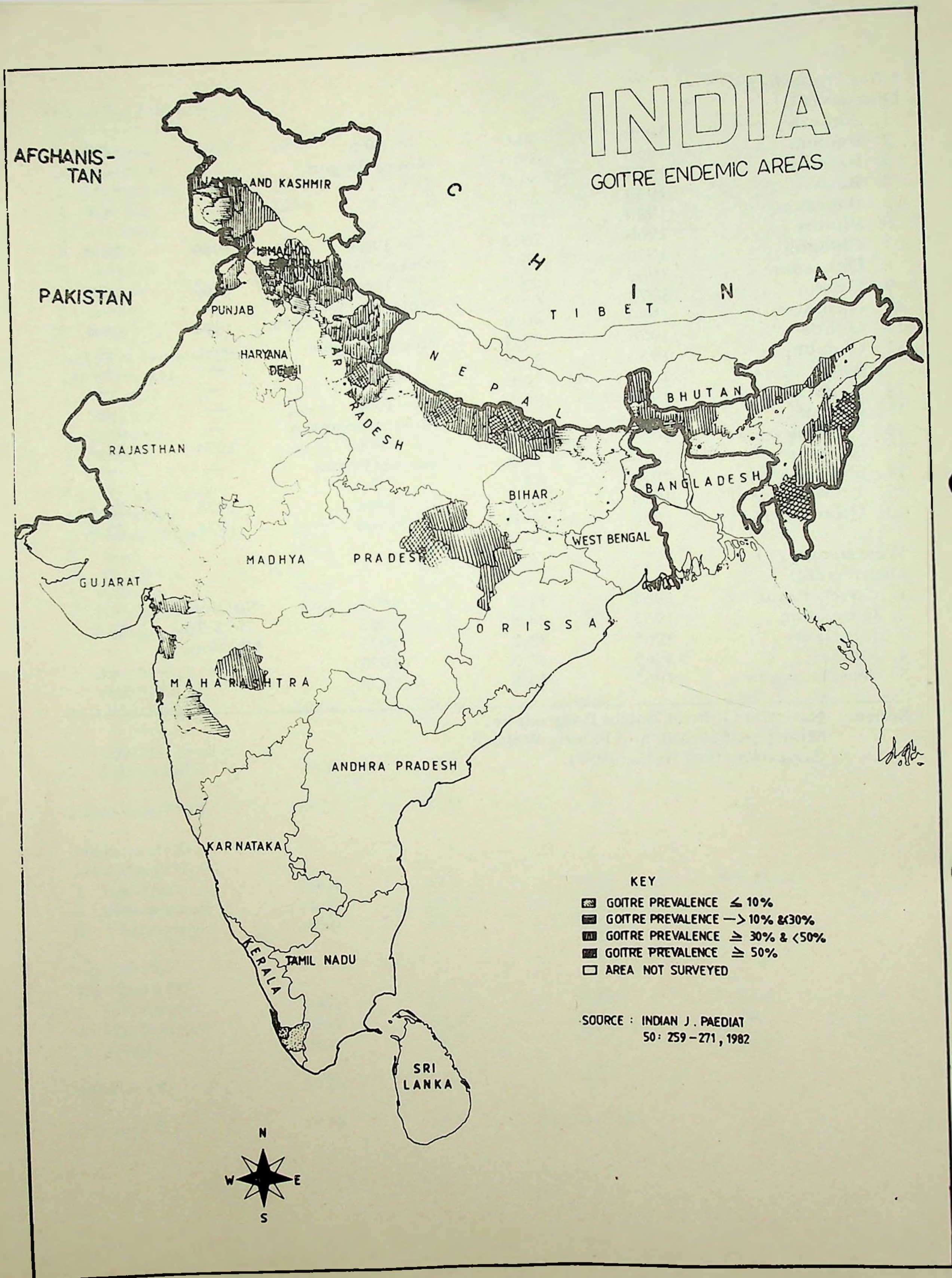
[Arranged in alphabetical order]

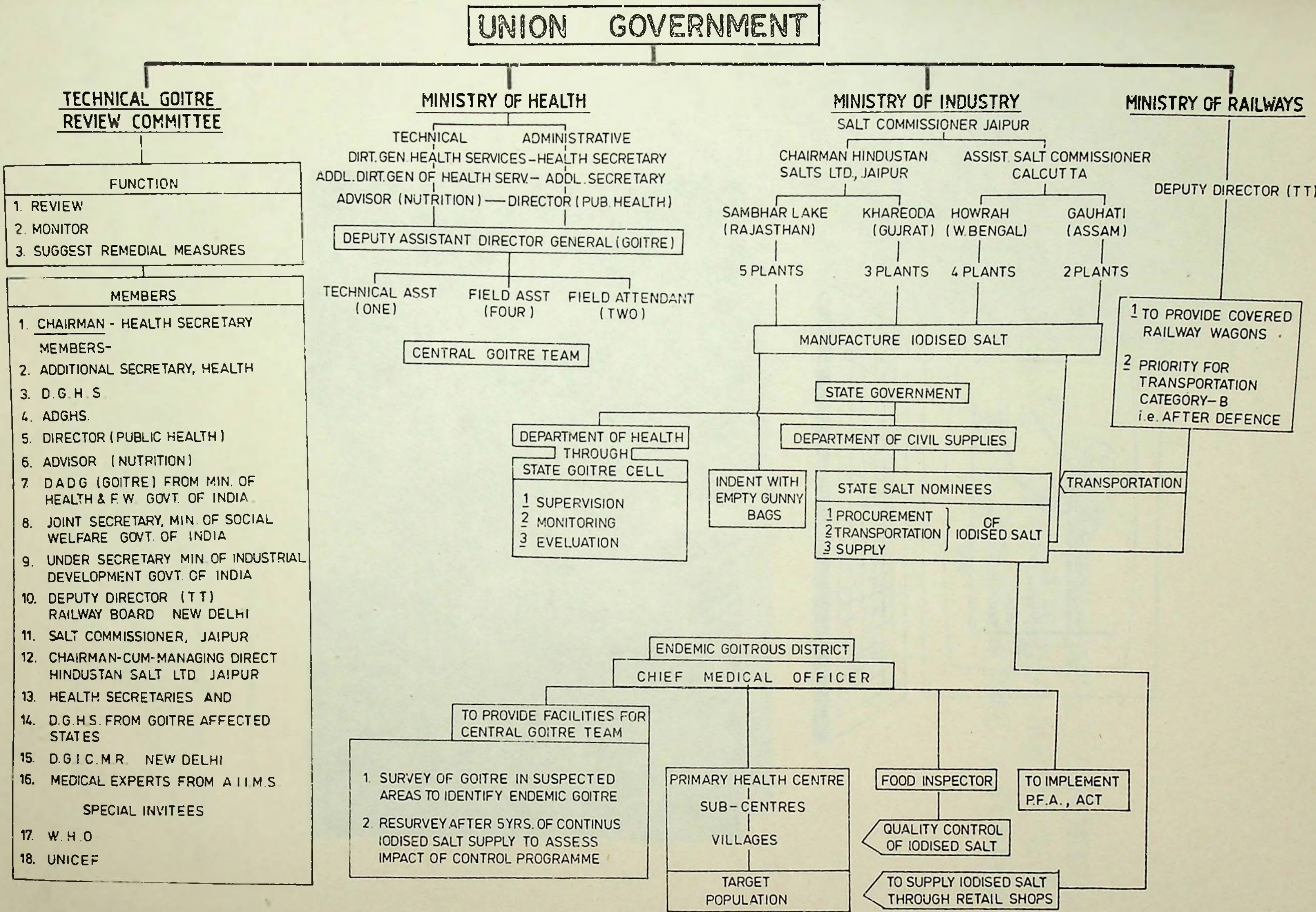
| State (S) Union Territory (UT) District (D) | Base line Survey Year | Goitre preva-lence % | Commencement of Iodated salt supply (year) | Resurvey (year) | Goitre Preva-lence % |
|---|---|---|---|---|---|
| *Arunachal Pradesh (UT)* | 1960 | 38.0 | 1965 | 1982 | 26.8 |
| *Assam (S)* | 1959-70 | | | | |
| *Districts (D)* | | | | | |
| 1. Cachar | | 15.0 | Not yet begun | — | — |
| 2. Darang | | 31.5 | " | — | — |
| 3. Dibrugarh | | 19.0 | " | — | — |
| 4. Goalpara | | 40.2 | " | — | — |
| 5. Kamrup | | 26.5 | " | — | — |
| 6. Lakhimpur | | 30.1 | " | — | — |
| 7. Nowgong | | 20.5 | " | — | — |
| 8. Sibasagar | | 13.2 | " | — | — |
| 9. United Mikir & H.C. Hills | | 12.9 | " | — | — |
| *Bihar (S)* | | | | | |
| *Districts (D)* | | | | | |
| 1. Champaran East | 1960 | 40.3 | 1964 | 1979 | 64.5 |
| 2. Champaran West | 1960 | 40.3 | 1964 | 1979 | 51.2 |
| 3. Darbhanga | 1962 | 23.2 | Not yet begun | — | — |
| 4. Hazaribagh | 1964 | 32.0 | " | — | — |
| 5. Muzaffarpur | 1964 | 41.7 | " | — | — |
| 6. Palamau | 1964 | 20.9 | " | — | — |
| 7. Purnea | 1962 | 26.5 | " | — | — |
| 8. Ranchi | 1964 | 10.2 | " | — | — |
| 9. Saharsa | 1962 | 20.5 | " | — | — |
| 10. Santhal Paragana | 1964 | 23.5 | " | — | — |
| 11. Saran | 1961 | 35.5 | " | — | — |
| *Chandigarh (UT)* | 1969 | 11.2 | 1968 | 1977 | 45.9 |
| *Delhi (UT)* | 1975-78 | 29.0 | 1984 | — | — |
| *Gujarat (S)* | | | | | |
| *Districts (D)* | | | | | |
| 1. Bharuch | 1977 | 31.7 | 1982 | Not done | — |
| 2. Valsad | 1983 | 36.6 | 1984 | " | — |
| *Haryana (S)* | | | | | |
| *Districts (D)* | | | | | |
| 1. Ambala | 1972 | 26.0 | 1969 | Not done | — |
| 2. Gurgaon | 1976 | 6.5 | — | — | — |

| | | | | | |
|---|---|---|---|---|---|
| *Himachal Pradesh (S)* | | | | | |
| *Districts (D)* | | | | | |
| 1. Bilaspur | 1959 | 25.7 | 1963 | Not done | — |
| 2. Chamba | — | — | 1963 | ,, | — |
| 3. Hamirpur | 1956 | 41.2 | 1963 | ,, | — |
| 4. Kangra | 1956 | 41.2 | 1957 | 1962 & 1968 | 32.1 & 9.9 |
| 5. Kinnaur | — | — | 1963 | Not done | — |
| 6. Kullu | 1956 | 41.2 | 1964 | ,, | — |
| 7. Mahasu | 1959 | 39.9 | 1963 | ,, | — |
| 8. Mandi | 1959 | 20.7 | 1963 | 1981 | 34.5 |
| 9. Simla | 1974 | 41.6 | 1964 | Not done | — |
| 10. Sirmor | 1959 | | | | |
| *Madhya Pradesh (S)* | | | | | |
| *Districts (D)* | | | | | |
| 1. Raigarh | 1980 | 34.4 | 1984 | | — |
| 2. Sarguja | 1981 | 41.8 | 1984 | | — |
| 3. Shahdol | 1976 | 55.6 | 1984 | | — |
| 4. Sidhi | 1979 | 37.8 | 1984 | | — |
| *Maharashtra (S)* | | | | | |
| *Districts (D)* | | | | | |
| 1. Aurangabad | 1973 | 35.0 | 1982 | Not done | — |
| 2. Jalna | 1983 | 35.0 | 1982 | ,, | — |
| 3. Amravati | 1983 | 46.2 | — | — | — |
| 4. Wardha | 1983 | 54.9 | — | — | — |
| 5. Buldhana | 1984 | 49.5 | — | — | — |
| Manipur (S) | 1970 | 32.0 | 1965 | ,, | — |
| *Meghalaya (S)* | | | | | |
| *Districts (D)* | | | | | |
| 1. Garo Hills | 1966 | 23.0 | Not Yet begun | — | — |
| 2. United Khasi & Jaintia Hills | 1966 | 7.0 | ,, | — | — |
| *Mizoram (UT)* | 1976 | 69.0 | ,, | — | — |
| *Nagaland (S)* | | | | | |
| *Districts (D)* | | | | | |
| 1. Khomia | 1960 | 32.5 | 1965 | Not done | — |
| 2. Mokochung | 1960 | 26.1 | 1965 | ,, | — |
| 3. Twen-song | 1960 | 50.2 | 1965 | ,, | — |
| *Punjab (S)* | | | | | |
| *Districts (D)* | | | | | |
| 1. Gurdaspur | 1961 | 52.3 | 1964 | 1969 | 42.3 |
| 2. Hoshiarpur | 1961 | 40.3 | 1964 | 1969 | 23.6 |
| 3. Ropar | 1969 | 9.3 | 1964 | 1982 | 45.8 |
| *Sikkim (S)* | 1976 | 37.8 | 1984 | — | — |
| *Tripura (S)* | 1970 | 17.0 | Not yet begun | — | — |

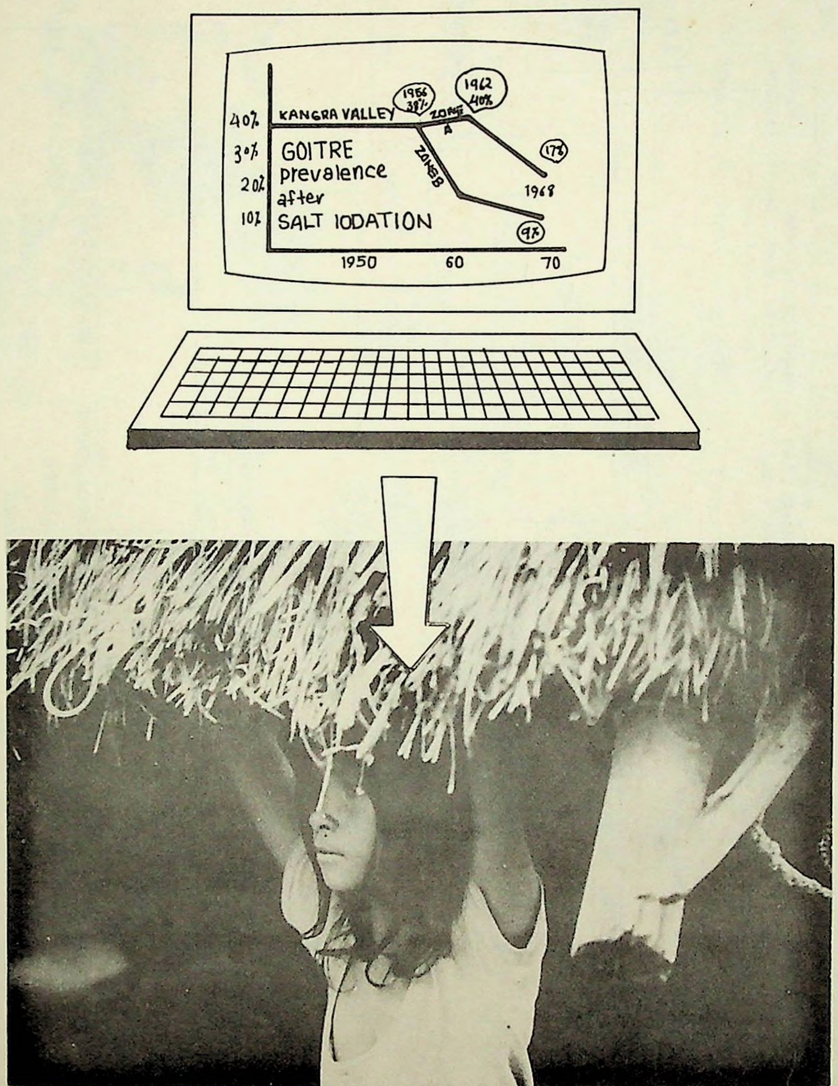
| | | | | | |
|---|---|---|---|---|---|
| *Uttar Pradesh (S)* | | | | | |
| *Districts (D)* | | | | | |
| 1. Almora | 1930 | 40.0 | 1966 | 1974 | 25.4 |
| 2. Badaun | 1956 | 55.0 | Not yet begun | — | — |
| 3. Bareilly | 1974 | 64.0 | ,, | | |
| 4. Basti | 1930 | 37.0 | ,, | — | — |
| 5. Bahraich | 1930 | 37.0 | — | — | |
| 6. Bijnore | 1960 | 23.2 | 1966 | 1969 | 16.9 |
| 7. Chamoli | 1930 | 40.0 | Not yet begun | — | — |
| 8. Dehradun | 1965 | 39.7 | 1966 | 1969 | 16.9 |
| 9. Deoria | 1973 | 65.9 | Not yet begun | — | — |
| 10. Garhwal | 1930 | 40.0 | 1966 | 1974 | 25.4 |
| 11. Gonda | 1978 | 65.9 | Not yet begun | — | — |
| 12. Gorakhpur | 1930 | 37.0 | ,, | — | — |
| 13. Kheri | 1962 | 20.0 | ,, | — | — |
| 14. Nainital | 1964 | 30.0 | 1966 | — | — |
| 15. Pilibhit | 1975 | 41.3 | Not yet begun | — | — |
| 16. Pithoragarh | 1930 | 40.0 | 1966 | 1974 | 25.4 |
| 17. Rampur | 1974 | 35.8 | Not yet begun | — | — |
| 18. Shahjahanpur | 1974 | 44.7 | ,, | — | — |
| 19. Tehri Garhwal | 1954 | 35.0 | 1966 | 1974 | 25.4 |
| 20. Uttar Kashi | 1930 | 40.0 | 1966 | 1974 | 25.4 |
| *West Bengal (S)* | | | | | |
| *Districts (D)* | | | | | |
| 1. Cooch-Bihar | 1965 | 21.7 | 1973 | Not done | — |
| 2. Darjeeling | 1963 | 34.5 | 1967 | 1975-76 | 35.6 |
| 3. Jalpaiguri | 1965 | 33.2 | 1973 | Not done | — |
| 4. Malda | 1965 | 10.3 | 1973 | ,, | — |
| 5. West Dinajpur | 1965 | 14.8 | 1973 | ,, | — |

Source: National Goitre Control Programme,
Ministry of Health and Family Welfare
Government of India (1985).


INDIA
GOITRE ENDEMIC AREAS
AFGHANISTAN
PAKISTAN
CHINA
TIBET
NEPAL
BHUTAN
BANGLADESH
SRI LANKA
JAMMU AND KASHMIR
HIMACHAL
PUNJAB
HARYANA
DELHI
UTTAR PRADESH
RAJASTHAN
BIHAR
WEST BENGAL
GUJARAT
MADHYA PRADESH
ORISSA
MAHARASHTRA
ANDHRA PRADESH
KARNATAKA
TAMIL NADU
KERALA
KEY
GOITRE PREVALENCE ≤ 10%
GOITRE PREVALENCE —> 10% &<30%
GOITRE PREVALENCE ≥ 30% & <50%
GOITRE PREVALENCE ≥ 50%
AREA NOT SURVEYED
SOURCE : INDIAN J. PAEDIAT 50: 259-271, 1982
N
W
E
S




ADMINISTRATIVE STRUCTURE OF NATIONAL GOITRE CONTROL PROGRAMME


40%
30%
20%
10%
KANGRA VALLEY
1956
38%
1962
40%
ZONE A
ZONE B
17%
1968
9%
GOITRE
prevalence
after
SALT IODATION
1950
60
70

ICCIDD INTERNATIONAL COUNCIL FOR CONTROL OF IODINE DEFICIENCY DISORDERS

IDD NEWSLETTER

VOLUME 12 ■ NUMBER 2 ■ MAY 1996



# Peru Progresses Towards IDD Elimination

The government of Peru requested an external evaluation of achievements made under the National Program for IDD Eradication (PRONEDDI). The consultation took place in late March 1996 with Dr. Eduardo A. Pretell, ICCIDD Regional Coordinator for the Americas, Dr. Gianfranco Fenzi, Professor of Endocrinology in Naples and ICCIDD Senior Advisor, Dr. Mauro Rivadeneira, ICCIDD Board member and representative for PSADDI (the Andean Regional Program) and UNICEF, Dr. Carlos Zamalloa, Regional Consultant in Nutrition for PAHO/WHO, and Dr. Juan C. Arraya, of the Unit of Nutrition (UPAN) of Bolivia. Before meeting with the government, Drs. Pretell and Fenzi visited seven parts of the country to obtain information on production and quality of iodized salt, goiter prevalence, urinary iodine levels, and knowledge about IDD in the population. The evaluation meeting was assisted by local representatives of the Medical College of Peru, the College of Nutrition, the Peruvian Endocrine Society, the National Center of Nutrition, the National Institute of Statistics and Information, the Project of Health and Basic Nutrition of the World Bank, the Embassy of Canada, PAHO/WHO, UNICEF, and the Ministry of Health. This article is based on the report submitted by Drs. Pretell and Fenzi.

## Background

The sierra and jungle regions of Peru have long been known as areas of severe iodine deficiency. Historical details have been documented frequently in the *IDD Newsletter*, most recently in 1995 (11(1):6). For baseline status, the 1986 survey gave a median goiter prevalence of 36% in the Sierra and Selva, and a median urinary iodine of 7.1 µg/dl, with 37% of samples below 5 µg/dl. The population at risk was estimated at six million. At that time the production of iodized salt was inadequate. Production by the state salt monopoly covered only 50% of the population's needs, and 40% of homes consumed salt without iodine. Iodine deficiency was not widely appreciated as a problem of public health.

In 1986 the Program established as its objectives the provision of adequate iodine to all the population as quickly as pos-

*Continued on page 18*

COURTESY G-F. FENZI

*Children clutching their packages of iodized salt parade in support of IDD control in Chachapoyas.*

## IN THIS ISSUE


COURTESY G.-F. FENZI.

*A fiesta in the Sierra, supporting iodized salt, the salt of life.*

sible, and the eventual achievement of IDD elimination. Between 1986 and 1995 the strategy changed as the program evolved. Education has been a major emphasis throughout. Iodized oil was extensively administered as a short-term solution in the earlier phases but recently has been used less frequently. In contrast, production and commercialization of iodized salt took years to put into place, but has been increasingly relied on in the last several years. Also, monitoring and surveillance have become much more prominent in the Program's organization.

Iodized oil was given initially to about two million people in 66 provinces of the Sierra, the population at greatest risk. In recent years, iodized salt has become the mainstay for iodine supplementation in those regions. For reasons of logistics and economic limitations, the greatest support for the increase in distribution of iodized salt has taken place primarily in the northern sierra area, and more recently this step has been introduced in the south.

## Current Status

At the meeting, Dr. Pretell and Dr. Fenzi, and the other external experts reviewed information supplied by the Ministry of Health, and discussed their own findings. They concluded that despite economic, political, and social difficulties that the country had between 1985 and 1995, PRONEDDI had made significant advances towards the goal of IDD elimination.

The level of risk and the prevalence of IDD are now controlled in the greater part of the country and have been significantly reduced in the remainder, as demonstrated by the following indicators:

*Iodized salt* - Peru has achieved the intermediate goal of universal iodization of salt for human consumption. The estimated volume of production of iodized salt in 1995, 132,000 metric tons, covers 112% of the potential demand, double that available in 1986. Now 60% of the production comes from the two large major producers, EMSAL and QUIMPAC, and 40% from 57 medium-sized and small producers who have become involved recently.

The quality of iodized salt has improved considerably. At the plant level, the mean iodine content is 40.5 ppm, with 64% of samples greater than 30 ppm (the legal requirements are 30-40 ppm). At the levels of shops and homes, the percentage of samples adequately iodized (greater than 20 ppm) has increased from 36% in 1992 to 75% in 1995, and the iodine content was greater than 10 ppm in 92% of samples. Correspondingly, the proportion of samples without iodine has been reduced from 32% to a current 3.2%.

Studies of salt consumption show an important change in the attitude of the population. Now 81.1% of housewives state that they use iodized salt, an increase of 20% over 1986, at which time only 69% of the salt was adequate iodized (i.e., greater than 15 ppm). The consumption was less in rural areas (64.4%) than

*Achievement of sustainable elimination of IDD in the country is promising.*

urban (74.4%) and varied in the different zones of the country, 85.9% in the Selva, 81.8% in the North Sierra, 69.9% in the Central Sierra, and 55.7% in the Southern Sierra.

Iodization of salt for animal consumption has begun. Two private companies have produced iodized block salt on a small scale. The Program has encouraged these trials and has established demonstrations in 64 farm centers.

*Urinary excretion of iodine* - This has been the principal indicator for the Program. Serial values clearly demonstrate the progress achieved in all zones of the country. In Sierra Norte, one of the two zones most severely affected, the deficiency is practically controlled, as shown by the progressive increase in median UI levels from 5.7 µg/dl (44.8% < 5) in 1986 to 12.8 µg/dl (20% < 5) in 1993 and to 13.8 µg/dl (15.9% < 5) in 1995. In the Sierra Centro and the Selva, zones with less severe deficiency, the median has also increased to normal levels, from a basal value of 9.5 µg/dl to 11.0 in 1993 and 15.2 in 1995 in Sierra Centro. In the Selva, initial values were 11.9 µg/dl and now are 18.8 µg/dl. Only in Sierra Sur has the change been more gradual, from 5.6 µg/dl (46.3% < 5) in 1986 to 10.0 µg/dl (34% < 5) in 1995. The overall level for the Sierra and Selva is 13.9 µg/dl, twice higher than the value recorded in 1986; 24% of samples were less than 5 µg/dl.

*Goiter prevalence in sentinel sites* - Thyroid size assessment by palpation in schoolchildren 6-14 years was carried out in each of eight communities studied in the basal survey of 1986, two each in Sierra Norte, Sierra Centro, Sierra Sur, and one in the Selva. Drs. Pretell and Fenzi made the evaluation in five of these. The results by zones show that the prevalence has diminished from 62.4 to 13.9% in Sierra Norte, from 41.7 to 5.7% in Sierra Centro, from 43 to 19.9% in Sierra Sur, and from 32.3 to 3.0% in the Selva. The median goiter prevalence in these eight localities has changed from 47.7 to 10.8%. In two zones these figures have already reached normal levels even though in Sierra Sur the change has been smaller.

Based on these three indicators, in accord with the criteria proposed by ICCIDD, the Sierra Norte and the Selva zones can be considered as free of IDD risk, although some small isolated foci persist and require attention. The Central zone is very close to meeting these standards for iodine sufficiency. In Sierra Sur the distribution and quality of iodized salt have increased considerably in the last year, and these intensified activities of promotion, surveillance and monitoring may result in control of the deficiency in a very short time.

At the national level, it is estimated that the population at risk has been reduced from 6 to 1.2 million people.

## Sustainability

Achievement of sustainable elimination of IDD in the country is promising. The creation of PRONEDDI and its development over the past ten years has been highly effective. The Program satisfies the following criteria:

1. *Organization* - PRONEDDI is a unit under the Director General of Health in the Ministry of Health, with a central director and functional organization including 29 coordinators of regions and subregions, in addition to 156 focal points at the primary level of health. This highly motivated and well educated network has developed among health personnel who work in the regions. The work of PRONEDDI is supported also by other national government organizations such as the Ministries of Education, Industry, and Agriculture, the National Program of Food Assistance, the Peruvian universities, and local governments.

2. *Political and economic backing* - The pledge by the country in supporting the World's Summit for Children and the National Plan of Action for Children, 1992/1995 includes the control of IDD as a high priority. This political decision has been reinforced with economic support from the public treasury, which for the period 1992-1995 contributed 42% of the total costs, and in addition, paid the salaries of those responsible for the Program at different levels of management. The Program also received economic and technical support from UNICEF Peru, OPS/OMS, ICCIDD, and the European Union. In the last three years, most of the external economic support has been channeled through UNICEF.

3. *Awareness among different sectors of the population* - Knowledge of the problem of IDD has spread extensively as a multisectoral activity through mass communication, schools, and community participation. The educational effort has included creative and innovative action at the community level. Drs. Pretell and Fenzi appreciated this important aspect during their field work when they talked with children in the streets on the problem of IDD, and evaluated the knowledge of salt plant workers on the importance of iodine deficiency and the contribution of iodized salt to health. (The accompanying illustrations show several aspects of community participation). Many educational programs for health workers and students have included regular training on IDD.

4. *Commitment of the private salt industry and other institutions* - Although legal instruments require iodization of salt, it is evident that, in addition, strong motivation exists among all levels of salt producers, and this fact is reflected in the increased output and better quality of their product in the last three years. Moreover, the great majority of the small and medium producers have complied with the regulations. The venture into the production of iodized salt for animals has led to demonstration farm projects for the benefit of the agricultural industry. The participation of the private sector and of the universities has also contributed to the technological development of local production of kits for quality control, machines for iodizing the salt, and salt drying sheds.

5. *Availability of iodine for salt iodization* - Currently, importation and distribution of $KIO_3$ is guaranteed through a rotating fund regulated by the Program, and also through direct importation of iodine by large and medium producers. It is expected that in the future, potassium iodate will be obtained directly by private industry.

6. *Availability of appropriate laboratory facilities* - The program has 14 laboratories distributed throughout the country for determining iodine in salt. This network permits an efficient and affordable system of surveillance and monitoring of iodized salt that corresponds with the national decentralization into existing 28 subregions of health. At the same time the program has access to the supporting facilities of the Laboratory of Endocrinology of the Universidad Peruana Cayetano Heredia for determining urinary iodine and hormone levels at low cost. This laboratory also supports programs of IDD control in other countries.

COURTESY G-F FENZI

*Drs. Fenzi (left) and Pretell palpate necks of children for goiter in Ollantaitambo.*


COURTESY G-F FENZI

*Iodized salt in Morrope, Chiclayo, waiting for distribution. The slogan states that the vendor is carrying out his responsibility by selling only iodized salt.*

## Conclusions

Since its creation PRONEDDI has had two important features, a strong technical component and political support from the government. These factors have permitted the design and implementation of strategies and activities to achieve and sustain its objectives. The cost-benefit ratio of the program is one of the lowest in America and more than 50% of expenses have been covered from the country's own resources.

## Recommendations

The external experts commended the program for notable advances in the control of IDD, but noted the persistence of risk in a small part of the population. To assure eradication of the problem and its sustainability, the group recommended that PRONEDDI be maintained in its current structure and operational scheme, with the following recommendations for its greater success:

1. Strengthen the central team of the Program, to assure its technical resources. Economic and technical support for this should be sought from external cooperation agencies, PAHO, UNICEF, ICCIDD, the Micronutrient Initiative, and bilaterals.
2. Improve the salt industry, particularly the small and medium producers, to gain more experience in the process of iodization and in salt drying, and thus to better the quality of local artisanal iodization. Maintain the rotating fund for purchase of $KIO_3$.
3. Give priority to technical assistance and management of the iodization plants in Sierra Sur, particularly the Maras plant in Cuzco and San Juan de Salinas in Puna, because of their strategic importance.
4. Ensure that 100% of the iodized salt from plants producing salt for human consumption comply with the legally established requirements (30-40 ppm) and that iodization in artisanal plants are adjusted to the required limits. Also, stimulate production and use of iodized salt for animals.
5. Expedite new legal instruments in accord with free market economics to permit more effective control of iodized salt quality.
6. Reinforce and promote alliances within and among different sectors in order to strengthen the program, particularly the sections dealing with education, farming, salt producers, and communication media.
7. Integrate the epidemiologic surveillance of the program with that of other micronutrients.
8. Establish an effective monitoring system in the supplemented population for the detection and management of cases of iodine-induced hyperthyroidism.
9. Offer immediate protection with iodized oil to the small population groups that cannot have adequate access to iodized salt.
10. Give appropriate publicity to the findings and results of this evaluation, for the benefit of other programs in other countries.
11. Maintain a follow-up of these recommendations and the previous advances of the program. ■

***Since its creation PRONEDDI has had two important features, a strong technical component and political support from the government.***

# Reports from the Regions

*This article offers highlights from the reports of the ICCIDD Regional Coordinators for the year 1995. We omit news that has already been presented in the Newsletter.*

## AFRICA

Dr. **Benmiloud**, Regional Coordinator, reviewed the many activities in Africa. Most have already been presented in the *Newsletter*. Dr. **Delange** organized a multicenter study in several African countries, assessing thyroid size, iodized salt intake, and urinary iodine levels. The assessment has been completed, the data are being analyzed and a full report is expected soon.

Dr. **Lantum**, Subregional Coordinator for Central Africa and Madagascar, reported his participation in seminars for small salt producers in Dakar, the African Task Force on Micronutrients, evaluation of the Cameroon National IDD Program, the African Task Force in Micronutrients held in Ethiopia, the development of a plan of action for IDD elimination in the Central African Republic, and the multicenter study of the impact of iodized salt on iodine status in Cameroon and Nigeria. Some country data follow.

**Central African Republic** - A plan of action had been developed, with Dr. Lantum's help several years ago, but was delayed during testing of water iodization with the Rhodifuse system. The latter method was found effective and interesting but could not surpass universal salt iodization in terms of cost benefit and feasibility. Renewed effort is now taking place by implementing the previous plan. UNICEF, the World Bank, and Micronutrient Initiative have expressed interest in supporting the new program. IDD is severe in the CAR, with national median urinary iodine concentration of 2.1 µg/dl.

**Cameroon** - The independent verification by the ICCIDD/WHO/UNICEF team has shown a reduction in total goiter rate from 29.4% in 1990 to 10.4% in 1995. Further results of the multicenter study will appear shortly. The Cameroon Minister of Health has authorized the creation of a national committee in charge of micronutrients.

**Equatorial Guinea** - An IDD baseline survey was conducted by Dr. John Ogbuta of Nigeria, and Dr. Lantum reports that an IDD problem was identified.

**Madagascar** - Universal salt iodization consumption was anticipated to be in effect beginning in December 1995.

**Sao Tome and Principe** - A masters thesis by Luis Ruiz (1993) for the University of London Institute of Child Health reported a cross sectional survey of 2,011 schoolchildren, 6-12 years old, that showed a total goiter rate of 50% and a visible goiter rate of 3%. The south district of Caue had a prevalence of 60%. The mean urinary iodine level in goitrous children was 6.7 µg/dl, and 9.5 µg/dl in nongoitrous. The amount of dietary fish correlated with urinary iodine levels. One myxedematous and five neurological cretins were described, and the island had a deafness prevalence of 1.9%. Iodized salt is not available in the market.

**Chad** - A national IDD survey was carried out between 1993 and 1994, revealing a total goiter rate of 64% for the Sahelian zone, 70% for the Sudanese zone and 25% for Ndjamena, giving a national average of 63%. The median urinary iodine concentration for these three zones was respectively, 3.7 µg/dl, 2.3 µg/dl, and 4.7 µg/dl, with a national median of 2.9 µg/dl. Values for urinary thiocyanate levels were respectively, 2.27, 2.74, and 2.95 mg/dl, with a national median of 2.48 mg/dl. These values are high when compared, for example, to Brussels, with a mean of 0.5 mg/dl. A salt survey found that 31% of the population was already consuming iodized salt, from 25% in the Sahel and 30% in the Sudan to 50% in Ndjamena. Millet of various species is widely consumed as a staple food, including the *pennisetum* species. Cassava is consumed either raw, boiled, or after soaking to prepare dishes. Thus two goitrogens - millet and cassava - are in the Chad diet. A national IDD seminar workshop took place in June 1994, followed by a short-term plan of action. Iodized salt continues to be imported from Nigeria, Cameroon, and Senegal.

Rwanda - A goiter survey carried out in 1990 showed that several districts were highly endemic, with an average total goiter rate of 50%, and a plan of action for 1990-1995 was developed. Since then, high risk groups in two sanitary regions, Gitarama and Gikongoro have received iodine supplementation with Lipiodol. A ministerial order required that only iodized salt should be sold. Also occurring during this five year period were training activities on monitoring, seminars to raise awareness of salt dealers, distribution of rapid field test kits, and establishment of a laboratory for analyzing iodine in salt. Since 1992 the IDD Control Program has been integrated into the Micronutrient Control Program in two pilot regions, with plans to extend this organization to the rest of the national territory. A short-term plan of action was developed and included the distribution of vitamin A capsules, iron tablets, and Lipiodol. Civil strife beginning in April 1994 abruptly halted the program. Currently, a new team is gradually trying to reintroduce the control of micronutrient deficiency.

## CHINA AND EAST ASIA

The Regional Coordinator, **Dr. Chen Zu-pei**, reviewed progress in his region. In China he cited 1994 data from the Ministry of Public Health as follows: population at risk for iodine deficiency, 727 million (out of the country's total 1.2 billion persons); 29 of the country's 31 provinces are endemic for iodine deficiency; eight million persons are recognized to have endemic goiter; and 187,000 are cretinous; and adults have a total goiter rate in of 1.79%, while children age 7-14 years have 13.01%.

The annual meeting of the National Leading and Coordination Group for IDD Control was held in Beijing in November 1995, and reaffirmed the importance of increasing awareness of IDD, especially for top leaders and policy makers, multisectoral coordination, reinforcing the function of the professional team or sector, universal salt iodization and the exclusion of non-iodized salt. The Annual Working Meeting for Endemic Disease Control in March 1995 drafted two major objectives, universal salt iodization by the end of 1995 or 1996, and implementation of a national monitoring plan. A follow-up workshop in September strengthened these efforts. At that time 80% of the provinces had universal salt iodization in place and the remaining 20% had made plans for its implementation by the end of 1996. Two problems were recognized: the proportion of households consuming effectively iodized salt (> 20 ppm) was only 50%; and the total need of iodized salt is about 7.8 million tons, but the current production capacity is only 6 million tons, leaving a deficit of 1.8 million tons. An implementation project supported by the World Bank may relieve this deficiency.

Using the WHO/UNICEF/ICCIDD recommended criteria for monitoring progress towards elimination of IDD, Dr. Chen concludes the following regarding IDD prevalence: Beijing and Shanghaino have no iodine deficiency (total goiter rate less than 5%); five provinces have severe IDD (TGR greater than 30%); eight provinces have moderate IDD (TGR 20-30%); and 14 provinces have mild IDD (TGR 5-20%). He also noted that about 50% of salt at the consumer level was effectively iodized (> 20 ppm), with a range of 12-79%, except in Jiangsu, with 95%.

An investigation of ten big cities showed that most had a total goiter rate above 5% and urinary iodine below 10 µg/dl, indicating that iodine deficiency is not restricted to remote or rural areas.

Regarding international cooperation, the IDD program has been jointly assisted by UNDP, WHO, and UNICEF in ten provinces. The World Bank developed an important project of support for light industry to improve the capacity, quality and distribution of iodized salt. A Sino-Swedish project on prevention and rehabilitation of iodine deficiency-related mental retardation will cover 14 counties with IDD in eight provinces.

Dr. Chen advised the Ministry of Public Health, on behalf of the National IDD Advisory Committee, on the use of iodine-rich food or tablets, a topic that was confusing some officials and health workers. The results were statements that iodized salt is a major intervention for IDD elimination in China, that iodized oil is a supplementary means for the national program, that both iodized salt and iodized oil are officially sanctioned, and that iodine-rich foods or tablets as competition to iodized salt, are not advocated.

## EUROPE

**Dr. Delange**, Regional Coordinator, reported. A major activity was the ThyroMobil project (*IDD Newsletter*, 11(3):33, 1995). Its methods were thyroid volume by ultrasound and urinary iodine determinations in school-age children in selected sites in 12 European countries. The final results are being tabulated. So far they show that iodine nutrition is markedly improved in many countries compared to the situation reported in 1992. However, iodine deficiency persists unchanged in some countries such as Belgium.

In other news, **Bulgaria**, has decreed mandatory iodization of household salt at a level of 20 ppm. Strict quality control has been organized and export of iodized salt produced in Bulgaria is no longer allowed. Beginning in February 1995, pregnant and lactating women and children to the age of 7 years are supplemented with tablets of iodide. The goiter prevalence in schoolchildren has decreased from 65 to 17% and urinary iodine increased from 3 µg/dl to 14 µg/dl.

In **Belgium**, a National IDD Committee of the Ministry of Health chaired by Dr. Delange, organized a consensus conference and made unanimous recommendations for advocacy programs, universal salt iodization and iodine supplementation of pregnant and lactating and young infants. The Minister of Health committed formally to implementation of these measures, but changes in the political scene delayed this action.

**Dr. Gerasimov**, Subregional Coordinator for Eastern Europe and Central Asia, reported. Surveys in several remote regions of Russia showed that parts of western Siberia (Tyumen province) and of eastern Siberia (Republic of Sakha-Yakutia) had moderate iodine deficiency, with some pockets more severe (median urinary iodine 2.5 µg/dl, ultrasound goiter rate 40-60%). Rural areas of Central European Russia also showed moderate levels of IDD (goiter rate 40-50%, median urinary iodine 2.9 µg/dl). This new information is important because only mild iodine deficiency had previously been thought to exist in Russia.

An IDD control program in Russia was adopted by the President's decree in 1994, but not implemented due to lack of funds. In other republics, programs are being developed in Kazakstan and Kirgizstan following the Ashkabad meeting (*IDD Newsletter* 10(4):44, 1994). Salt iodized with KI (25 ± 10 ppm salt) is being produced in Russia, Ukraine, Byelarus, and Kazakstan, but is of rather low quality. No legislation on USI has been adopted in the countries of this subregion, and there is no information on the amount of iodized salt produced.

Iodized oil has been used to a limited degree in Tadjikistan. Lipiodol capsules were also delivered by the International Red Cross to some regions of Russia and Ukraine that were exposed to radioactive fallout by the Chernobyl disaster.

The bread iodization project was described in an abstract in a recent *IDD Newsletter* (12(1):15, 1996). The Ministry of Public Health has expressed considerable interest towards implementing bread iodization in regions of severe and moderate iodine deficiency where iodized salt is not available.

## MIDDLE-EAST

Dr. Anna Verster, WHO Regional Advisor in Nutrition, reported.

### Country activities

**Afghanistan** - Although the country still suffers civil unrest, the severe problem of IDD has been recognized. Efforts are underway to start salt iodization locally at the various sites where salt is produced. WHO has provided iodized oil for distribution to children and women during the second and third round of the immunization campaign. Iodized salt from Iran is available in Heart and Kandahar.

**Cyprus** - Reports to WHO on the neonatal screening for TSH suggest that no IDD problem exists in the country.

**Egypt** has taken the political decision to iodize all salt. Discussion on technical issues, especially iodide/iodate and the possibility of iodization of "kitchen salt" took a long time. WHO and UNICEF assisted the government in making a suitable decision.

UNICEF carried out one round of iodized oil in the worst affected area, with WHO technical input. Iodized salt is reportedly under production starting May 1, 1996 after the standards were adjusted to allow for iodization. Salt comes from the sea, and is iodized with $KIO_3$ through spraying. The total annual production is 2 million kg. All edible salt will be iodized, either as coarse salt or refined.

**Iran** reports reaching 87% consumer coverage with iodized salt. Fifty-two small-to-medium producers all over the country produce excellent quality iodized salt, which is also exported to some parts of Afghanistan. Iran has a comprehensive monitoring system, and IDD is included in the primary health care system. Iodized salt was given to all families during the polio campaign (*IDD Newsletter* 10(4):48, 1994). The salt in Iran is from different sources, sea salt, rock salt, and lake salt. All edible salt is iodized by spraying with $KIO_3$ using country-specific technology. An excellent monitoring system is in place.

**Iraq** - In 1993 a national survey of 3,004 school-age children showed goiter rates of 24-44%. The salt included in the ration given to all Iraqis is now iodized. A 1995 survey showed that 49-85% of families use iodized salt. Salt legislation exists.

**Jordan** in 1993 carried out a national survey that showed a moderate/severe problem. The biggest salt manufacturer (Al Azraq) was using iodide in a process which involved heating of the iodized salt in a drying tunnel with iodine losses. On the advice of WHO and UNICEF consultants, iodate has been substituted for iodide, UNICEF now provides the iodate, and the salt is adequately iodized. The second manufacturer, Al Amra, has just started iodizing all salt for human consumption. Dr. Verster assisted in the development of a monitoring system for iodized salt integrated into the existing food control system with links to the National IDD Committee. She recommended expanding the standard for iodized table salt to include all edible salt. WHO has funded a small study to assess iodized salt in pickles. The salt used is either from wells in the desert (Al Azraq) or from potash in the Dead Sea. The compound used is $KIO_3$, which is sprayed onto the salt.

**Kuwait** - Although there are no date yet on IDD prevalence, the main salt producers in Kuwait have agreed to start iodizing their salt.

**Lebanon** has carried out a national survey. IDD is moderate/severe. The country has a decree stating that all salt imported or produced must be iodized. The two factories in the country both use iodate to iodize all edible salt (50,000 kg). The sea is the source of salt and it is iodized by spraying. A survey of salt consumption was carried out by a MSc student for UNICEF, looking at 30 clusters of 15 households each. Of 461 samples, 84% were adequately iodized with iodate (334 samples) or iodide (54 samples). In Beirut and its suburbs, over 90% of salt samples were adequately iodized. The cut-off used for deciding adequacy was high, > 50 ppm of iodine. The legislation is Lebanon requires 50-100 ppm, a rather high value in view of current experiences with losses.

**Libya** has been assisted by WHO in setting up or improving the laboratory capacity for IDD. All is now set for a national survey to evaluate the effect of the salt iodization program, which has been ongoing, particularly in remote areas where IDD is a problem. WHO will provide technical support. All edible salt (120,000 kg) is presently iodized with $KIO_3$ at 26 ppm. The salt is from salt lakes. Recommendations to increase the iodization level and to change to iodate have been made.

**Morocco** has carried out a national IDD survey that showed IDD to be a problem of public health significance in the country, with highest goiter prevalences in the mountains (44%) and lowest on the coast (19%), with a national average of 22%.

In March 1995, the government held a one-day national seminar to present the data and discuss strategies. WHO participated actively. Iodized oil was distributed in Azal, Taza, Chefchaoun, Ouarzazate, while other hyper-endemic areas will be targeted in 1995/96. A salt situation study was done and a meeting held with producers. Seventeen iodization plants provided by UNICEF are now functioning. Several salt producers have formed cooperatives or produce under the same label. A logo has been adopted (a tajine). Legislation was adopted by the Ministries of Health, Agriculture, Commerce and Industry, and Energy and Mines, to iodize all edible salt at 80 ppm ± 10 ppm (Ministerial decree of October 1994). A KAP study was done which will assist in IEC.

In September 1995, Morocco planned to begin a neonatal screening program using TSH and $T_4$ in neonates coming for BCG (day 7-30 days postpartum) to detect congenital hypothyroidism. This will start in Rabat, initially, in collaboration with the IDD control program.

**Oman** has carried out its national IDD survey and found mild IDD nationally, with higher prevalences in some areas. The country both imports salt and produces it locally. A Ministerial decree has been issued to ensure that only iodized salt is imported. Also, the only local producer is iodizing his salt after receiving technical advice from WHO/EMRO. On a recent visit to the Dutch salt producer AKZO, Dr. Verster was informed that Oman has changed its order from non-iodized to iodized salt.

**Pakistan** has recently taken up iodized salt with renewed vigor and extensive support from UNICEF and the World Bank. Access to iodized salt has been increased through support to the private sector provided by the Iodized Salt Support Facility (ISSF). Advocacy for iodized salt legislation is underway. Most salt is rock salt and dry mixing is the technique chosen. Further details on the program in Pakistan are provided elsewhere in this issue of the *Newsletter*.

**Qatar** - A preliminary study on iodine deficiency disorders was carried out in January 1996. Urine specimens from 59 children (30 boys and 29 girls, 6-15 years) randomly selected from 10 primary schools in Doha showed an average iodine content of 23.37 μg/dl with 70% of the samples above 10 μg/dl. A national study was proposed.

**Saudi Arabia** informed WHO about the results of its neonatal screening program. IDD is prevalent in some areas of the country. Iodized salt is available although no legislation as yet regulates USI. The first ever national IDD survey was recently completed. It showed a mild-moderate prevalence, with severe IDD in the south, based on goiter prevalence in 8-10 year old schoolchildren. However, the urinary iodine levels were not congruent with this. Median urinary iodine excretion varies from 11 μg/dl in the south to 24 in the west, with a national mean of 17 ± 8 μg/dl and a median of 18. In the south, 45% had an excretion below 10 μg/dl, compared with 19% in the north and 15% in the east. The report's authors, who include the Assistant Deputy Minister of Health for Preventive Affairs, recommended universal salt iodization, a view supported by WHO and UNICEF. There is now need for a decree and standards. A new regional association of iodized salt producers has been created, and the salt producers need to be informed of its existence.

**Sudan** has made the political decision to iodize all salt. WHO and UNICEF are actively involved as advisors. A National IDD Committee has been formed, and iodization plants have arrived. Legislation endorsing salt iodization was passed by a Ministerial decree. A proposal for a monitoring system was recently prepared and WHO technical support was given through a short-term consultant.

**Syria** has recently received and installed new iodization plants. The main mine was already producing some iodized salt but only 20% of the national need. The new plants have increased the capacity to 100% of the national need. Syria's salt comes from a deep mine with a capacity of 80,000 tons per year. Most is iodized by spraying $KIO_3$ while some is dry mixed in an automatic mixing drum.

**Tunisia** reviewed its targeted iodized salt program in 1992-93 and found that the iodization level was too low, and showed IDD occurred in several parts of the country. Tunisia has, with support from WHO and UNICEF, taken the decision to reinstate universal salt iodization with adequate iodine (40 ppm).

**Yemen** - A decree to enforce iodization of salt in the whole country was accepted by the Council of Ministers. Some iodized salt is presently produced in Yemen and UNICEF has provided additional iodization equipment. An IDD committee was formed. WHO assisted technically in setting up the salt monitoring system, by providing a consultant who has carried out training of laboratory staff and by provision of equipment.

### Regional Activities

WHO/EMRO has provided technical support to a number of countries (notably Jordan, Yemen, Sudan) in the area of monitoring of salt iodization programs and their impact on IDD. Technical support and training in laboratory techniques for IDD control was given to Iran, Yemen, and Libya. WHO supported a study in Jordan on the possible effect of iodized salt on pickles which showed no effect on taste, appearance or consistency of locally made pickles from several different types of vegetables.

A joint regional WHO/UNICEF meeting on universal salt iodization for salt producers was held in Amman and at the Al Azraq Salt Works in Jordan. The meeting resulted in the formation of a Regional Association of Iodized Salt Producers, which is already actively networking. On the basis of the experiences of the salt producers attending, the participants recommended that:

1. All countries of the region affected by iodine deficiency should have effective legislation and standards for iodized salt.
2. The use of iodized salt must be made universal.
3. Every country should have an IDD committee which monitors process and impact of salt iodization and gives feedback to the producers.
4. Potassium iodate should be the compound of choice for all salt iodization in the region.
5. Potassium iodate should be exempted from taxes and/or customs duties.
6. The school education system should be used for monitoring at the household level and for social marketing.
7. For marketing purposes and to promote iodized salt, videos and other promotional materials should be produced by governments and salt producers in collaboration with WHO and UNICEF.
8. The newly formed Association of Iodized Salt Producers should look into development of one or more logos for iodized salt.
9. WHO and UNICEF were requested to continue to support the salt iodization program.

## AMERICAS

**Dr. Pretell** reported. Many activities in the Americas have already been reported in this and previous issues of the *IDD Newsletter*, particularly on Peru and Paraguay.

In December, Dr. Pretell participated in the 5th Annual Meeting of the Andean Subregional IDD Project, in Caracas. In all of the five Andean countries the production of iodized salt for humans is more than sufficient to cover the potential demand. The five countries have carried out national surveys on goiter, urinary iodine, and consumption and quality of iodized salt. Results on iodized salt production, consumption, and quality are encouraging. Iodization of salt for animal consumption has not been implemented yet, except in Peru (see this issue, *IDD Newsletter*). Two projects on iodine deficiency in animals have been developed there in collaboration with the National Agrarian University La Molina (Lima) and the National University Hermilio Valdizán (Huanuco, in the Andes). Preliminary results demonstrate significantly low concentration of iodine in milk of cattle from the Sierra (2.9 ± 1.9 µg I/dl) in comparison with those from the coast (21.6 ± 19.9 µg/dl). These results are quite similar to previous observations in humans and are being used for advocacy among farmers.

Dr. Pretell summarizes the current situation of countries as follows:

*IDD nearly eliminated and sustainability likely* - This group includes Costa Rica, Nicaragua, Ecuador, Bolivia, Chile, Peru, Venezuela, Colombia, and Brazil. In each, the amount of iodized salt available for human consumption is greater than the potential demand. All but one of these countries have active national IDD control programs. Each has governmental and private salt industry support. Seven of the nine have laboratory facilities for urinary iodine analysis. All have a strong education program. All have conducted recent national surveys. External evaluation is needed and should be the next step.

*Some IDD still exists* - In these countries, Mexico and Argentina, there is little governmental concern about IDD as a health problem and no recent evaluations have taken place.

*Iodized salt available but no recent evaluation* - These countries include Guatemala, Honduras, Salvador, and Panama. They need evaluations on impact of iodized salt and may need technical assistance.

*Countries without USI* - These include Uruguay and Paraguay. The latter was reviewed in a recent *IDD Newsletter* (12(1):3, 1996), and considerable progress is being made. In Uruguay, promising efforts are taking place to implement USI, and IDD elimination is expected fairly soon.

Dr. Pretell proposed the following activities for 1996: (1) external evaluation of the IDD programs in Bolivia, Chile, and Peru, each of which has expressed the need. (Since the report was submitted, the Peru evaluation has already occurred, see this issue of *IDD Newsletter*). Colombia and Venezuela have also made significant progress, and external evaluation needs to be considered. (2) Brazil has completed data collection from a national survey of goiter prevalence, urinary iodine concentration, and the iodine content of salt. Analysis is in progress and Dr. Pretell has been invited to a workshop in Brasilia to review the results and a plan of action for the future. (3) Technical assistance is needed for reassessment of their remaining IDD areas in Argentina and Mexico and development of intervention programs as necessary; the governments of these two countries are generally unaware of their IDD status. (4) Despite apparent progress of salt iodization in Central America, recent data on production and quality control are not available nor are impact evaluations. These need attention.

## SOUTHEAST ASIA AND PACIFIC

Dr. Pandav has already provided detailed reports on various aspects of IDD in Southeast Asia in recent issues of the *IDD Newsletter* (11(4):45, 1995). His report to ICCIDD for 1995 includes valuable country profiles for each country, with data on salt iodization, utilization of iodized salt at the household level, and biological markers (urinary iodine, goiter, neonatal TSH), when available. New information from these data sheets is being tabulated in ICCIDD's CIDDS database. ■

# Iodization of Irrigation Water Proves Successful in Western China

Addition of iodine to irrigation water was reported to be a successful means for improving human iodine nutrition in western China (Lancet 1994, 334:107-110, abstracted in *IDD Newsletter*, 10(4):51, 1994). The same research group has continued their observations and Dr. DeLong (ICCIDD Board member) provides a recent summary for the *IDD Newsletter*. His co-authors are **Jiang Xin-min, Cao Xue-yi, Jiang Jiung, Ma Tai, David W. James, Murdone abdul Rakeman, Dou Zhi-hong, Mahmud Mamette, Kareem Amette,** and **Zhang Ming-li**, from the Xinjiang Endemic Diseases Research Institute, Urumchi; the Xixjiang Health and Anti-Epidemic Station, Urumchi; Tianjin Medical College, Tianjin; Utah State University, Logan, Utah, and Duke University Medical School, Durham, NC. The present article summarizes some of their major findings to date. Full publication will follow.

*Iodine addition technique* - From a 200 liter tank, placed on a platform over an irrigation canal, a solution of 5% potassium iodate was dripped into the water flowing beneath, to produce iodine concentrations of 10-80 μg/l in the canal water. Dripping occurred over two to four week periods in May to July. The administrations included 30 kg of iodine to an area of four villages with a total population of 5600 in Long Ru in 1992, and another 80 kg to the same area in 1993. Also, in 1993, 80 kg iodine were added in an area of eight villages with a population of 15,600 in Bakechi, and in 1994, 80 kg were administered to an area of 15 villages, total population of 25,000, in Tusala.

*Iodine in water and soil* - A surprising finding was that the content of iodine in the soil, expressed as μg/kg, was regularly about three times that in the water, expressed as μg/l. The authors suggest that this increase in water-soluble soil iodine reflects an action of $KIO_3$ in solubilizing soil iodine that was previously insoluble. This result is being further explored.

*Iodine uptake by plants* - The iodine content in wheat and cabbage increased several fold in the two years after initiating the iodization, beginning within several weeks and persisting for at least two years. The effects on major grain crops were uncertain.

Rice productivity increased markedly in 1994 and 1995 in the test villages only, raising the possibility of a beneficial effect of iodine on rice production. Corn yields in the test villages rose, but did also in control villages. Mean productivity of wheat remained constant.

*Effects on animals* - The uptake of iodine by the thyroid increased two to three fold in sheep and chickens, the two species in which it was measured. In Long Ru this effect persisted for at least three years, but in Bakechi, values returned to baseline in two years. The iodine content of mutton, chicken, and eggs also increased markedly, rising about six fold in chickens after two years, for example. Egg iodine content increased two to three fold, and remained high even after the second year.

*Iodine helped humans and also improved animal health.*

*Effects on animal health* - The relative number of sheep increased by 10% in the test villages, and the total number by 6.9%, compared to controls, in Long Ru. Similarly, in Bakechi, the relative increase was 10.1% and in Tusala, 5.1%. The survival of newborn lambs increased significantly in all three test areas. For example, in Long Ru, the increases over the pretreatment years for the three years 1993, 1994, and 1995, were respectively 42%, 63%, and 35%, while similar figures for the control villages were -1.2%, +20%, and +15% for the same three year period, compared to the three previous years.

*Human urinary iodine excretion* - In Long Ru, the median rose from 14 μg/l before dripping to 49 μg/l one year later, and then decreased to 18 and 21 μg/l for the respective next two years. For women, the median urinary iodine excretion was 51 μg/l in 1994, one year after the last dripping, and 29 μg/l in 1995. In Bakechi, initial levels were about 40 μg/l, and two years after the last dripping, the median was 78 μg/l for women and 58 μg/l for children.

*Effects on children* - Measurements of height, weight, and head circumference of children aged 2-6 years were compared between iodinated and control villages. For each, the mean values for the treated children were greater than the controls, but not always significantly so. Further studies are being planned.

*Cost of intervention* - The authors calculate that for Long Ru the cost was about US $0.10 per person. The principal expense was the iodate, which was available only at the Chinese commercial price, about twice the UNICEF price; if the UNICEF price had been available, the cost would have been almost half. For Bakechi, the estimate was considerably lower. These calculations include only cost on a human per capita basis. The benefits for livestock are significant. For example, in Long Ru, the value of the increased sheep production was estimated to reach 88,000 yuan in 1995 alone, compared to the total cost of applied iodine of 14,000 yuan. Chicken productivity would also increase the benefit cost ratio.

## COMMENT

These results are exciting from at least several vantage points. First, they show that iodization of irrigation water is a practical, cost-effective means of iodine supplementation under the circumstances existing in this area of western China. Secondly, they offer valuable preliminary data on the great benefits iodization has for human and animal development. Further data and conclusions from this research will be awaited with much interest. ■

# Iodized Salt in Peshawar, Pakistan: Its Iodine Content, Price, and Use by the People

*(The following article was submitted to the* IDD Newsletter *by Dr. Mati ul Haq, Thyroid Laboratory, Institute of Radiotherapy and Nuclear Medicine, Peshawar, Pakistan. Co-authors included Dr. Iftikhar Ahmad, Dr. Salarzai, and Dr. Sher M. Khan. The article has been shortened, edited, and adapted for the* Newsletter*).*

About 20 million people live in iodine-deficient areas of Pakistan. Of these, 8 million show some manifestation of iodine deficiency, and at least a million show some degree of mental retardation. Goiter prevalence reaches 20% in children of age 0-19 years in the Northwest Frontier Province. The government of Pakistan is committed to virtual elimination of IDD through universal salt iodization by the year 2000. The recommended concentration of iodine is 70 ppm, at a price of rs 2.50/kg and packing size of 800 grams in polyethylene bags (1,2).

The purpose of the present work is to evaluate the iodine content in the available iodized salt to address the following questions: (1) is the iodine content constant among batches?; (2) are salts sold according to the recommendations of UNICEF/WHO and the Planning and Development Department of the government?; (3) what percentage of people use iodized salt?; and (4) why do some people not use iodized salt?

To carry out the study, we collected at retail points 21 samples of iodized salt from different manufacturers, for assessment of iodine. Exactly two months later different batches of the available brands were collected from the same shops. We randomly chose 1244 families to interview for their attitudes towards iodized salt. The iodine content of salt was determined by standard iodometric titration (3-5).

Of the 21 brands, only five contained adequate amounts of iodine (70 ppm). An additional five brands contained 30 ppm or above. The remaining 11, (52%) had less than 30 ppm. The overall range was 7 to 153 ppm. Three brands had levels greater than 125 ppm.

On repeat sampling of 11 brands two months later, some showed only minor differences, but in others the differences were huge. Examples of some differences are given as follows, comparing the first and the second determination: (a) 75.5 vs. 27.1 ppm; (b) 14.1 vs. 49.4; (c) 55.7 vs. 42.8; (d) 37.6 vs. 25.0; (e) 19.4 vs. 29.5; (f) 69.5 vs. 131.5; (g) 52.9 vs. 35.4. Repeat sampling for the remainder of the 12 brands corresponded more closely to the initial values.

All manufacturers offered their salt in plastic bags, according to national and international recommendations. Thirteen (62%) of these supplied the recommended 800 gram packages, the remainder supplied salt either in larger or smaller containers. The price range was rs 2.7 to 8.75 per kg of salt. Most manufacturers sell iodized salt at two to three times the recommended price. The retail price shows no correlation with the iodine content.

The survey of 1244 families showed that only 241 (19%) used iodized salt. An additional 10% occasionally use it, while the remaining 70% never do. When questioned about why they did not use iodized salt, 44% answered that it causes failure of the reproductive system, 26% stated that it was too expensive compared to non-iodized salt, and the remaining 30% felt that the iodized product had no advantage.


*"Hand and Pot" symbol for iodized salt in Pakistan.*

These results show that most of the iodized salt available to the consumer at retail points does not have an adequate or constant supply of iodine. The price is considerably higher, and for this reason, 26% feel they cannot afford it. Additionally, 70% do not use iodized salt because of misunderstanding or ignorance of its benefits. The authors recommend an effective nation-wide IDD commission, with the following responsibilities:

1. To improve awareness at all levels about the importance of IDD and the use of iodized salt. Consumers need to know that iodized salt is beneficial for the reproductive process and the physical and mental development of infants and children and that it has no adverse effects.

2. To have regular monitoring of the iodine content of salt at the plant, retail and consumer levels.

3. To ensure an adequate and cheap supply of potassium iodate or potassium iodide for the salt industry.

4. To educate consumers to demand and use only iodized salt. ■

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# Effects on Storage and Commonly Used Spices on Stability of Iodized Salt in Indonesia

*A paper and abstract were kindly made available to the* IDD Newsletter *by Professor Dr. I. N. Arhya, Department of Biochemistry, Udayana University, School of Medicine, Bali, Indonesia. The following abstract summarizes his findings.*

Salt is fortified with $KIO_3$ in Indonesia at 40 ppm. This study examined its stability under different conditions.

The first experiments evaluated the effects of open-air exposure in six brands of iodized salt, each claiming to have 40 ppm iodine. After three months, the water content of five of the brands increased but stayed within the standard requirement, less than 5% moisture. The sixth brand started with a moisture content of 5.2%, and reached 6.9% three months later. Initial iodine contents of the six brands were respectively, 60, 53, 50, 27, 9, and 4 ppm. After three months, the same brands had 53, 44, 43, 22, 5, and 2 ppm, respectively. After an additional two months, the levels were 31, 24, 24, 12, 0, and 0 ppm, respectively. The approximate losses in the first three months for each brand were 17%, 14%, 19%, 39%, and 53%, respectively. Thus, for the first three brands, the levels remained above 40 ppm after three months of storage. For the other three brands, the iodine content was insufficient even when freshly produced, and much greater losses occurred during the ensuing three months. These three inadequate brands had a generally lower quality and a much lower price than the other three.

From these results, the Indonesian practice of keeping salt in open containers has little effect on water or iodine content of iodized salt. Most Balinese families require an average 350 g (range 50-500 g), salt per week, so a 500 g package will usually last for one month or less. While one to two months may elapse between production and purchase, consumption still takes place within three months of production. It may be concluded that for quality control purposes, measuring the iodine content of iodized salt in the factory alone will be sufficient. The conclusions about $KIO_3$ stability were supported by finding that even boiling $KIO_3$ for five minutes in water or meatball stew at a neutral pH did not affect its concentration appreciably.

The author also investigated the effects of many spices common used in Indonesian cooking. The spices use for this research were: aqua (as control), garlic (*allium sativum*), candle nut (*aleurites moluccana*), galingale (*keampferia galanga*), red onion (*allium cepa*), ginger (*zingiber officinale*), galangale (*alpinia galanga*), turmeric (*curcuma domestica*), tomato (*solanum lycopersicum*), chili (*capsicum annuum*), fermented shrimp paste (*terasi*), coriander (*coriandrum sativum*), pepper (*piper nigrum*), complete spice mixture (*bumbu lengkap*), sour vegetable spice (*bumbu sayur asem*), mixture of spices with coconut milk (*bumbu iodeh*), and hot mixed spices (*bumbu plecing*). Most spices when mixed with iodized salt lowered its iodine concentration, but not below 40 ppm. Tumeric and tomato lowered it to levels between 30 and 35 ppm. Mixture with chili led to the almost immediate disappearance of its iodine. The author suggests that this might be caused by the high vitamin C found in tomato and particularly in chili, which he attributes to the mixing of $KIO_3$ with an acid to release free iodine, which then volatilizes. The other foods such as shrimp paste, tumeric, and pepper also produced acid. Most of the iodine content was also lost when iodized salt was mixed with a complete spice mixture, sour vegetable spice, some species of coconut milk, or hot mixed spices.

Dr. Arhya concludes that the government's effort to control IDD by iodizing table salt will be futile if cooking habits are not modified. However, modifying such habits is difficult to carry out in practice, and he proposes an alternative program, such as capsules of iodized oil, supplying iodine in domestic animal foods to provide iodine-rich meat, or perhaps processing seaweed to produce fertilizers for agriculture. ■

*[Ed note: These results raise serious questions about losses of iodine in spice mixtures. More investigation is needed to characterize this effect further and to assess its practical consequences.]*

# Nigeria Advances Towards IDD Elimination

*This article is adapted from a report entitled "Status of Iodine Deficiency Disorders in Nigeria 1993-1995" by Egbuta and Hettiaratchy, presented by Dr. John Egbuta. Dr. Egbuta, recently elected to the ICCIDD Board, is currently a Project Officer for micronutrients with UNICEF Lagos, and has been a senior research fellow, Department of Chemical Pathology at the University of Jos. Dr. Nimal Hettiaratchy is Chief of the Nutrition Section of UNICEF in Lagos.*

## BACKGROUND

Previous reports have clearly established a significant presence for IDD in Nigeria (*IDD Newsletter*, 7(1):2, 1991), and more recently, have described the efforts to correct it through iodized salt (*IDD Newsletter*, 11(2):31, 1995). Dr. Ekpechi, ICCIDD Senior Adviser and former Board Member, produced a map in 1986 showing a significant goiter prevalence in many parts of the south, central and western regions, but reliable information was not available for most of the country. In 1992, Dr. Bailey and Mr. Mannar, both ICCIDD Board members, summarized goiter prevalence information for seven hyperendemic local government areas, ranging from a 16% goiter prevalence in Bassa (Plateau State) to 36% in Enugu State.

## IDD STATUS

Because there was insufficient information about the extent of IDD in Nigeria, Egbuta and Hettiaratchy carried out a rapid comprehensive goiter survey in 1993. They examined 17,500

*With evidence that the former approach was not working, it became necessary to explore other directions including private sector involvement, strong media mobilization and legislation.*

children from the entire 30 states of the country, and collected 3500 urine samples. Sampling was by palpation in 50 boys and 50 girls, usually age 9, in each school, the latter selected to be representative of their districts. Ultrasonography was also used for assessing thyroid size in two regions.

The report gives data for each state. The national average for goiter prevalence, defined as thyroid enlargement in over 5% of children, was 20%. By zone, the prevalences were 37.2% in the southeast, 28.7% in the southwest, 12.5% in the northwest, and 13.4% in the northeast. This 1993 survey found a higher goiter prevalence than had been estimated before. The authors suggest that this apparent worsening may be due to increased dietary cassava, whose thiocyanate is goitrogenic. In the 1970's when the economy was better, people could vary their menu with non-cassava-based diets. However, with a poorer economy in the 1990's, cassava was again the major dietary staple. Thus, the combination of iodine deficiency and increased reliance on cassava may have worsened the goiter prevalence.

## STRATEGY DEVELOPMENT

This survey was part of a new operational strategy for IDD in Nigeria. For more than 15 years the plan to control IDD had been largely unsuccessful because planners and researchers had embarked on a unidirectional strategy, expecting the government to be the key player. With evidence that this approach was not achieving satisfactory results, it became necessary to explore other directions including private sector involvement, strong media mobilization and legislation. In addition, an assessment of the current status of the salt industry was undertaken. This included a systematic listing of importers of salt, through the Ministry of Trade of Commerce.

## IODIZED SALT

Nigeria has only three major salt companies (Dicon, Nascon, and the New Nigerian Salt PLC). (The role of Dicon in salt iodization was described in the *IDD Newsletter* 11(2):31, 1995. All of the country's 630,000 metric tons processed annually are imported. Of this amount, Dicon processes 500,000 metric tons, Nascon 50,000, and New Nigeria 80,000. In addition, the three companies produce non-iodized industrial grade salt, respectively, at 60,000, 10,000, and 40,000 metric tons per year, for a total of 110,000. At an estimated consumption of 5-7 grams per day per person, Nigeria's annual requirement is 450,000-550,000 metric tons. Dicon iodizes its salt at source in Australia before shipment to Nigeria; the other two companies have iodization plants in Nigeria.

The importation and processing of salt in Nigeria is handled by the private sector. The salt industries were mobilized through high-level advocacy and workshops and seminars. Several visits and meetings were held with the salt importers on a bilateral basis and as a group, for the purpose of advocacy and monitoring. As a preliminary step UNICEF sponsored the attendance of some key officials of the salt companies at the West African Regional Meeting on salt iodization held in Dhaka, Senegal in 1992. After intensive promotional efforts, the Standards Organization of Nigeria developed a memorandum of understanding with the salt importers, and by the beginning of 1993 the salt industries had become partners with the Standards Organization and UNICEF in salt iodization.

### Program Operation

Legal provision for mandatory salt iodization was a key factor in negotiations with the salt companies. The strategy for this developed late in 1992 during the consultancy visits of Dr. Bailey and Mr. Mannar, leading to agreement by the Federal Ministry of Health and the Standards Organization to jointly develop mandatory iodization of all food-grade salts in the country. The Standards Organization then decreed that non-iodized salt would no longer be allowed to be imported or produced in Nigeria after January 1, 1994.

Media mobilization was another important ingredient. Previously there had been almost no knowledge of IDD, but the involvement of the media was enlisted through workshops, conferences, and seminars. In 1993 alone, IDD was featured 11 times on national television and radio prime time news, beamed to 30 million TV viewers and 60 million radio listeners. An IDD documentary and jingles were produced for constant airing on television and radio, and a national IDD logo was prepared and is embossed on every salt bag sold in the country.

Following the introduction of universal salt iodization, a form was designed and circulated to all field offices of UNICEF, the Standards Organization of Nigeria, the National Agency for Food, Drugs Administration and Control, and the National Primary Health Care Development Agency. These field offices were given several vials of the field test kits for the measurement of iodine in salt, and charged with monitoring and evaluating the progress of USI through monthly assessment of all the salt available and circulated in all parts of Nigeria.

Results from these tests have been impressive. By December 1994, 97% of households were consuming iodized salt.

## CONCLUSIONS

The apparent figure of 97% iodized salt consumption is extremely impressive. The authors make several suggestions for its sustainability. One is adherence to the regional agreement on universal salt iodization for West African countries of 1994, to prevent introduction of non-iodized salt across the country's borders. The authors also suggest strong emphasis on awareness creation and greater social marketing about the benefits of iodized salt. It is important to develop a reliable monitoring and evaluation system in which the services of regulatory agencies, including the Standards Organization, Food and Drug Administration, and universities, can be applied. Finally, the current regulations must be enforced in order to protect the consumer. ■

# Goiter Prevalence and Use of Iodized Kitchen Salt in Iringa Rural District (Tanzania)

P. FRANCESCONI, B.S. KIBIKI, V. PISANI, CUAMM COLLEGE FOR HEALTH COOPERATION, IRINGA AND IRINGA DISTRICT IDD CONTROL COORDINATION

Iodine deficiency disorders affect an estimated 25% of the population in Tanzania. A law effective in early 1995 prohibited manufacture of non-iodized salt. Iringa Rural, a northern district of the southern region of Iringa, is inhabited by an estimated population of 413,504 people. Visible goiter has been said to be 3.1%, but may be much higher in the surrounding mountainous areas; for example, a routine school survey in 1994 suggested 7% visible goiter.

The present study was conducted to survey the prevalence of goiter and the circumstances under which it occurs, and also to assess the proportions of households and retail shops using iodized salt, and knowledge about iodized salt in the population.

## Methods

*Goiter survey* - 45 primary schools were randomly selected in each geographical zone, and three classes selected from each, to give a total of 5,573 children for survey by examination for visible goiter (grade 2 and 3 by the old WHO system, grade 2 by the new system) (see *IDD Newsletter* 10(4), 1994), and also for visible goiter when the neck is fully extended (grade 1B, old system, would be included in grade 1 in the new classification). Additional data were obtained on age, shoe-wearing, and shirt condition, the latter two as indices of socioeconomic status.

*Household surveys* - Health officers or assistants visited households or shops, and in each, collected a sample of salt and questioned the household members or shop keepers to test knowledge and learn abut use of iodized salt. Also, the iodine content of salt was first screened by kits, and positive samples then collected for quantitative measurement by iodometric titration. The field workers were previously trained during a three-day workshop that included a pretest of procedures and tools in a sample village. In analyzing the data, analyses from three villages were excluded because of inconsistencies on repeat examination.

## Results

*Goiter prevalence* - The overall prevalence of visible goiter for the district was 12.0%, varying from 3.0% in the lowlands to 18.6% in the mountains. The prevalence of 1B goiter was considerably greater in each zone, so that the total goiter prevalence, measured as the sum of grades 1B, 2, and 3, was 54%, with a range from 44.5% in the lowlands to 63.9% in the highlands. The overall prevalence was 46.2% in males and 61.7% in females. The difference among age groups from 6 to 20 years was small. Children who were barefoot had a slightly higher goiter prevalence (57.7%) than those with shoes (48.9%).

*Iodized salt use at household and retail level* - Iodized salt was available in 264 of the 309 households visited (85.5%). In 17 of the 309, non-iodized salt was present, while no salt was found in the remaining 28 households. Of the 264 positive samples from the field tests, 159 were randomly selected and examined with titration to quantitate the level of iodine. Of these, 38.8% had more than 40 ppm, 32.3% were between 25 and 40 ppm, 15.7% were 18-24 ppm, and 13.2% were less than 18 ppm. Extrapolating these results to the total number of households visited, we find that 60.5% of the households use salt with an iodine content of 25 ppm or higher.

*The recent regulation on salt production is having a good impact. Iodized salt is present in all the villages.*

Of 99 salt samples taken from retail shops, only 12 were not iodized. Overall, 61.6% had an iodine content equal or higher than the threshold level of 25 ppm, and 31.3% contained more than 40 ppm.

*Practice and knowledge about kitchen salt* - Of the households visited, 90.9% had salt available. The average consumption, estimated through interview, was 9.2 grams/person/day. We found that 81.8% of the households use salt only for cooking; the remainder use it also at the table. Salt was variously stored in closed tins (42.6%), in a packet (28.6%), in an open container (19.7%), or in a bottle (9.2%). A few households (4.6%) washed the salt before use. Most of the salt (81.9%) is bought within the village, at an average price of 240 Tsh/kg, most frequently in half kilogram packages (61.4%).

Fifty-one percent of the interviewees had heard about iodized salt, but only 18.6% knew the type that they had purchased and only 9.6% were aware of precautions to be taken during storage of iodized salt.

## Conclusions

The overall goiter prevalence in Iringa Rural was higher than had been previously reported. This may be due to previous underestimation or possibly to a recent increase. At least three of the nine divisions of the district (Kilolo, Kiponzelo, and Mlolo), with a population of 203,248 people, have a prevalence severe enough to consider the use of iodized oil.

The recent regulation on salt production is having a good impact. Iodized salt is present in all the villages and its content generally indicates limited loss of iodine before reaching the household. If we accept a daily consumption of 9.2 grams salt per capita, and assume a 30% average loss of iodine during the cooking process (unpublished document, Tanzanian Food and Nutrition Center), we can calculate that 62.5% of the Iringa Rural population ingests more than the recommended 150 μg of iodine per day.

Further research is needed to properly evaluate the average consumption of salt at the household level, and more importantly, the average intake of particular groups at risk (pregnant women and infants), which may well be well below the average). ■

# ABSTRACTS

## IODINE DEFICIENCY. A NATIONAL PROBLEM. MEDICAL SPECTRUM, 16, (21-22), NOVEMBER 1995

These issues of the Journal of the Pakistan Medical Association are devoted to IDD, principally in English, but with summaries in Urdu. They include general information about IDD and the means for its correction, some of it adapted from ICCIDD publications. It also describes a study of TSH levels in cord blood from 884 infants born in hospitals in Islamabad, Lahore, Karachi, and Quetta, showing that 72% had high TSH levels. Further details are not given, such as cutoff for this determination, but this result presumably reflects transient neonatal hypothyroidism, a well recognized consequence of iodine deficiency. These data include Karachi,a city not previously regarded as iodine deficient, and more details on methodology are necessary, but the findings imply that much more of Pakistan is iodine deficient than previously recognized.

The *Spectrum* also describes the Pakistan Iodized Salt Project, which works with the salt industry to promote iodized salt. When it began in 1994, about 5% of salt consumed in Pakistan was iodized, while by late 1995, that number was over 40%. Initially, only three salt processors were iodizing salt, but that number had increased to over 400 less than two years later. Pakistan has about 600 salt processors, most of them using simple technology on a small scale. The Project has been offering them technical support to incorporate iodization into their processing. Simultaneously, a campaign to sensitize consumers to the need for iodized salt was developed. A key component has been the cooperation and enthusiasm of the salt industry. The article summarizes some key lessons from experience so far: (1) the efforts to stimulate demand should occur simultaneously with efforts to increase the availability of iodized salt; (2) to make the program effective, the private sector salt producers need to be convinced to invest their own funds and they will then be committed to iodization in order to protect and advance their own investments; (3) legislation should be developed along with programs that work with the private sector, rather than being promulgated in a vacuum; and (4) nonprofit social marketing organizations can provide a critical link between the public and private sector, because international donors and governments are often not structured to work directly with the private sector.

The article describes organization of the current program in some detail. Severe iodine deficiency has been long recognized in Pakistan, particularly in the north, as described previously in the *IDD Newsletter*. Efforts during the last decade with iodized oil and iodized salt met with limited success. In 1994 a new strategy was developed, based on (1) government commitment for IDD elimination with USI; (2) involvement of the private sector to make iodized salt available; and (3) effective education. Supporting legislation has been developed, approved by the Federal Cabinet, and awaiting National Assembly ratification.

A major development was the Iodized Salt Support Facility (ISSF), a division of Social Marketing Pakistan, an NGO. Its goals are to motivate salt processors to iodize salt, and to create demand for it. The ISSF provides: (1) motivation - this includes education, appeal to patriotic and humanitarian spirit, and the likelihood of higher profits; ISSF regarded it as crucial that the salt producer invest his own resources into necessary technological improvement, because it insured his personal involvement in seeing that iodized salt be purchased; (2) technical assistance - ISSF provides advice on equipment, $KIO_3$ purchase, and testing; and (3) marketing - the first step was new packaging, brand names, and incorporation of national logo. The additional costs of iodization are low, therefore, the slight increase in price is usually acceptable if accompanied by a general education campaign on the benefits of iodized salt. For communication, the logo of "Hand and Pot" shows salt being dropped into a cooking pot by a woman's hand, with the words "iodized salt" in Urdu. The national slogan translates "health from generation to generation," to appeal to sentiments of family and long-term use.

Additional parts of the campaign have included advocacy with government officials, religious leaders, NGO's, and the salt sector. Events include public gatherings, seminars, training sessions, and conferences. An advertising campaign was beamed to consumers and the retail distributing network and included all media. Important partnerships were established with government and NGO officials, salt marketers, teachers, and advertising agencies. A retailer's kit was developed to help retailers promote the benefits of iodized salt, and include trade promotion brochures, calendars, mobiles, stickers, posters, and a rapid test kit. Other groups targeted in the communication efforts were community leaders and NGO's, to include iodized salt in their health-related activities; health-care providers, for example, by distributing prescription pads with iodized salt logos, slogans and messages to 25,000 doctors across the country; children, targeted through a master's training program for teachers and by providing story books about IDD issues; and religious leaders, because of their enormous influence in communities.

## IODINE NUTRITION IN POLAND, AN EXAMPLE OF PROGRESS.

*Z. Szybinski, F. Delange, M. Gembicki, I. Kinalska, A. Lewinski, J. Nauman, J. Podoba, M. Rybakowa, L. Szewczyk, R. Wasikowa, Z. Zdebski,* The Thyroid and Iodine, *edited by J. Nauman, D. Glinoer, L. E. Braverman, U. Hostalek, published by Schattauer, Stuttgart. Merck European Thyroid Symposium, Warsaw, May 16-18, 1996, page 43.*

This article reports progress in Poland since the 1993 report (summarized in *IDD Newsletter* 11(3):38, 1995). Based on new ultrasound criteria for goiter, the previous data were recalculated, and reported for the country, subdivided into seven major geographical areas. The prevalence of goiter, by ultrasound, ranged from a low of 9.6% in areas bordering the sea to 43% in the Sudeten; median urinary iodine excretions ranged from 57.5 μg/l in the eastern plains to 91.6 μg/l near the sea. The ThyroMobil project (*IDD Newsletter* 11(3):33, 1995) covered four areas, not evaluated in the previous survey. The mean goiter prevalence, by ultrasound criteria, was 32% (range 14.2-55.4%) and the median urinary iodine excretion was 63.8 μg/l (range 32.0-93.1 μg/l). In preliminary results from a study of 102 pregnant women, median urinary iodines were 59 μg/l both in the first trimester and at the end of pregnancy, with respective thyroid volumes of 14.2 and 20.8 ml. Twenty women were given 150 μg iodine per day; by the end of pregnancy their urinary iodine levels were 96.7 μg/l and their thyroid volume had increased only slightly (from 15.6 ml to 16.8). The one and the five-minute Apgar Scales for newborn infants of the 20 supplemented women were 9.7 and 9.9, respectively, compared with 8.9 and 9.5 for the unsupplemented. The Ballard Scale score was 38.7 for supplemented versus 37.3 for unsupplemented.

Based on these results, the Polish Council for Control of Iodine Deficiency Disorders recommends urgent implementation of mandatory iodine prophylaxis with iodization of kitchen salt at 30 ppm and an additional supplementation of 150-200 µg iodine/day for pregnant women.

**SEVEN DEADLY SINS IN CONFRONTING ENDEMIC IODINE DEFICIENCY, AND HOW TO AVOID THEM.** *J. T. Dunn, University of Virginia Health Sciences Center, Charlottesville, VA, USA. J Clin Endocrinol Metab 81:1332, 1996.*

The author noting that iodine deficiency has major consequences and its treatment is straightforward, muses on why it continues to exist as a public health problem. Citing examples, he lists seven errors that frequently occur in iodine supplementation programs, with suggestions for their avoidance. The seven are: (1) *unreliable assessment of iodine deficiency* - the best indicators are urinary iodine concentration, thyroid size (preferably by ultrasound), blood spot thyroglobulin levels and neonatal TSH determinations, and the best group for surveys is schoolchildren; (2) *poor iodine supplementation plan* - iodized salt is the preferred supplement, but potential problems in its implementation need to be addressed, particularly extensive changes in salt production and marketing; other measures including iodized oil, iodized water, and iodine drops are occasionally useful, but the long-range solution should usually be iodized salt; (3) *exclusion of relevant stakeholders* - all groups with a stake in the problem of iodine deficiency or its solution should be included in developing a program; these groups include health authorities, other branches of the government including education, agriculture, and standards, the salt industry, health professionals and the iodine deficiency community itself; (4) *inadequate education* - all levels, from government to affected population, need to understand the effects of iodine deficiency, the importance of its correction, and the means for doing so; (5) *insufficient monitoring* - the best instruments are urinary iodine levels, iodized salt use and thyroid size measured in representative groups at regular intervals with public reporting of results; (6) *inattention to costs* - iodization increases the cost of salt production, and this increase needs to be recognized and distributed fairly; and (7) *nonsustainability* - the program must be fair to all relevant parties and accompanied by a regular system of appropriate monitoring; otherwise, it will not be sustained. ■

# IN BRIEF . . .

■ Conference on Sustainable Elimination of IDD in Africa - Held in Harare, Zimbabwe, April 22-24, hosted by the government of Zimbabwe and jointly sponsored by ICCIDD/UNICEF/WHO and the government of Zimbabwe. Dr. Judith Mutamba, ICCIDD Subregional Coordinator for Eastern and Southern Africa, played a key role in the organization of the meeting. Opening statements were made by Ms. J. Tagwireyi, Director, National Nutritional Unit, Ministry of Health, David Alnwick (UNICEF), L. Arevshatian (WHO), and Dr. Hetzel (Chairman, ICCIDD). An opening address was given by the Honorable Dr. T. J. Stamps, Minister of Health of Zimbabwe. Dr. Delange (ICCIDD, Executive Director) delivered the keynote address. The attendees included about 250 delegates from 45 African countries, included 7 ministers of health and industry. Major support was provided by WHO, UNICEF, and the national governments. ICCIDD, WHO, UNICEF, MI, and the government of Zimbabwe, as well as private industry, contributed to the core budget. Conference objectives included assessing progress in Africa towards IDD elimination, continuing political commitment, identifying necessary measures for sustainability, particularly monitoring, and strengthening information exchange. The conference report has been prepared in draft form, and will be published shortly. The program included regional reports, country case studies and working group sessions on monitoring, evaluation, and training, meeting the challenge in the sustainable elimination of iodine deficiency, integrating micronutrient control programs, food fortification and control of micronutrient deficiency, and a final panel discussion chaired by Dr. Hetzel. The principal outcome of the meeting was evidence of major progress towards the goal in most countries; Mr. Alnwick proposed a figure of 12 million infants saved from brain damage. Also achieved was the integration of IDD within the African Task Force for Micronutrient Deficiency, chaired by Dr. Benmiloud, Vice-Chair of ICCIDD. The question of iodine-induced hyperthyroidism (IIH) was discussed extensively; Minister Stamps insisted that this serious problem should not question the major benefits from USI programs. Dr. Delange reviewed the multicenter study of 7 African countries in assessing the impact of salt iodization level on iodine status. Iodine deficiency has been eliminated from all of the sites investigated in these countries, a major achievement. Although iodine overload was evident in many of them, no additional cases of IIH were found in the survey. The major problems identified were in the salt network, including the level of production of iodized salt in some salt plants, unreliability of test kits, and the need for reconsidering figures for the stability of iodine in iodized salt. ICCIDD representatives at the conference included Hetzel, Benmiloud, Delange, Mannar, Mutamba, Pandav, Ling, Asuquo, Bailey, Kavishe, Lantum, Ntambue, Siandwazi, and van der Haar.

■ **United States/Japan Common Agenda Includes IDD Control** - This two-country Common Agenda is part of a framework for a new economic partnership in addressing critical global challenges in areas including health, population, environment, technology, and economic development. In a recent meeting between Prime Minister Hashimoto and President Clinton, over 20 projects in 5 broad categories were listed. Among those for health and human development, it was stated "we will explore cooperation on the control of iodine deficiency disorders and support of micronutrient programs in developing countries." Several members of ICCIDD, including Dr. Irie, Mr. Haxton, and others were active in coordination with UNICEF in placing IDD on this agenda.

■ **World Health Assembly 1996** - This organization officially passed the resolution on IDD, previously approved by its Executive Council, and reported in the last issue of the IDD *Newsletter*. This action reaffirms the commitment to achieve the sustainable elimination of IDD.

■ **PAMM and Sister Cities International** - Sister Cities International is a nonprofit, nongovernmental organization that seeks to develop partnerships between US and foreign cities to increase global understanding and cooperation at the municipal level. Currently, over 1,000 US communities are linked with more than 1600 communities in 120 nations worldwide. The program fosters exchanges of ideas, expertise, and cultural understanding. PAMM (Program Against Micronutrient Malnutrition) is well known to readers of the *Newsletter* as a collaborative effort between Emory University and the US Center for Disease Control working towards the elimination of micronutrient deficiencies, particularly iodine, vitamin A, and iron. It acts in close coordination with ICCIDD on the prevention of iodine deficiency. More information on the partnership with Sister Cities International can be obtained from PAMM, 1518 Clifton Road, N.E., Atlanta, Georgia 30322, USA. ■

## RECENT PUBLICATIONS

*The Thyroid and Iodine*, edited by J. Nauman, D. Glinoer, L. E. Braverman, U. Hostalek, published by Schattauer, Stuttgart, New York - This book consists of papers from the Merck European Thyroid Symposium in Warsaw, May 16-18, 1996. Many papers relate to iodine deficiency and its correction, and some are being abstracted in this or other issues of the *IDD Newsletter*.

*Iodine Supplementation in a Goitre Endemic Area, with Special Reference to Pregnancy and the Neonatal Period*, by Babikir Elnagar. Uppsala University, 1996 - This dissertation summary reports several clinical studies on iodine deficiency and its treatment, particularly in Sudan; some are being abstracted in the *IDD Newsletter*.

*USI Update* - This periodic summary by UNICEF reports progress in universal salt iodization with short paragraphs on many countries. It is available from USI Update, Nutrition Section, H-10F, Program Division, UNICEF, 3 UN Plaza, New York, NY 10017, USA; fax (212) 326-7336; E-mail ndalmiya@unicef.org.

*The State of the World's Children 1996* - This annual publication reports issues and progress for children. It has useful tables on development trends by country. Available from UNICEF, New York.

*Micronutrient Fortification of Foods* - This book, a joint publication of the Micronutrient Initiative and International Agricultural Centre in Wageningen, provides background information and techniques of food fortification with vitamin A, iron, and iodine. Major sections include: developing a food fortification program; food vehicles and fortificants; food fortification techniques; quality assurance and control; legislations and regulations; review of research and current practices; opportunities for multiple fortification; and implementation issues and research needs. It is available by contacting Dr. Mahshid Lotfi at the MI, BP 8500, 250 rue Albert, Ottawa, Canada K1G 3H9.

*Bangladesh IDD Newsletter* - Initial issues of this publication were in January and April 1996, in English and Bengali. It contains general information on IDD, with particular emphasis on Bangladesh, and is published by the National Coordinator Office for ICCIDD in Bangladesh, c/o Institute of Nutrition and Food Science, University of Dhaka, Dhaka 1000, Bangladesh; fax 880-2-865583; E-mail QStullah@Agni.Com.

ICCIDD INTERNATIONAL COUNCIL FOR CONTROL OF IODINE DEFICIENCY DISORDERS

**The International Council for the Control of Iodine Deficiency Disorders (ICCIDD)** is a nonprofit nongovernmental organization dedicated to the sustainable elimination of iodine deficiency throughout the world. Its activities are supported by donations from CIDA, UNICEF, the World Bank, SIDA, AIDAB, the Netherlands Ministry for Development Cooperation, USAID, the World Health Organization, and others. Inquiries about membership in the ICCIDD should be directed to the Executive Director, Dr. Delange.

The *IDD Newsletter* is published quarterly by ICCIDD and distributed free of charge in bulk by international agencies and also by individual mailing. The *Newsletter* welcomes comments, new information, and relevant manuscripts. Inquiries and subscription requests should be sent to the Editor, Dr. Dunn. Communications about different geographical regions can also be directed to the respective Regional Coordinators.

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ICCIDD INTERNATIONAL COUNCIL FOR CONTROL OF IODINE DEFICIENCY DISORDERS

# IDD NEWSLETTER

VOLUME 12 ■ NUMBER 3 ■ AUGUST 1996



## Bolivia Conquers Iodine Deficiency

For the past 15 years Bolivia has conducted a determined fight against its severe endemic iodine deficiency, with excellent progress. In August 1996, the Government invited a term of external consultants to assess its progress, with particular reference to the criteria and guidelines for sustainable IDD elimination recommended by ICCIDD (*IDD Newsletter* 11(2):19, May, 1995). The team consisted of four ICCIDD Board members, Dr. Eduardo Pretell, Dr. Mauro Rivadeneira, Dr. Frits van der Haar and Dr. John Dunn, as well as Mr. David Alnwick (UNICEF/New York), Dr. Aaron Lechtig (UNICEF/Bogota), and Dr. Wilma Friere (PAHO/Washington). The group met over three days, conducted a field trip to Oruru,

*Continued on page 34*

COURTESY E. SCHOFFELIN/UNICEF

COURTESY E. SCHOFFELIN/UNICEF

*Stages in iodized salt production, Bolivia. (Left) Harvesting salt from the vast Uyuni salar. (Right) Packaging iodized salt into blocks.*

### IN THIS ISSUE

and discussed the program extensively with national personnel, including Dr. Juan Carlos Arraya, Dr. Carmen Daroca, Dr. Javier Torres Goita, Lic. Jose Rivero, and others. A summary of the group's findings follows.

## Background

IDD has long been a major problem throughout Bolivia. A survey in 1983 reported a country-wide goiter prevalence of 65%, with 59% in the least affected department. The course of IDD over the last ten years has been chronicled extensively in previous issues of the *Newsletter* (4(4):1, November 1988, 7(2):9, May 1991, 8(2):16, May 1992, 10(2):16, May 1994, and 11(1):6, February 1995).

The initial strategy was to develop a national salt iodization program (PRONALCOBO), administer about 1.7 million doses of iodized oil orally as a temporary measure, and conduct intensive education campaigns. A semi-autonomous corporation, EMCOSAL, developed iodizing cooperatives among groups of small producers and aggressively promoted proper packaging and distribution of iodized salt throughout the country. EMCOSAL was dissolved in 1994, having completed its purpose, and salt iodization was left in the hands of the country's approximately 52 private salt producers.

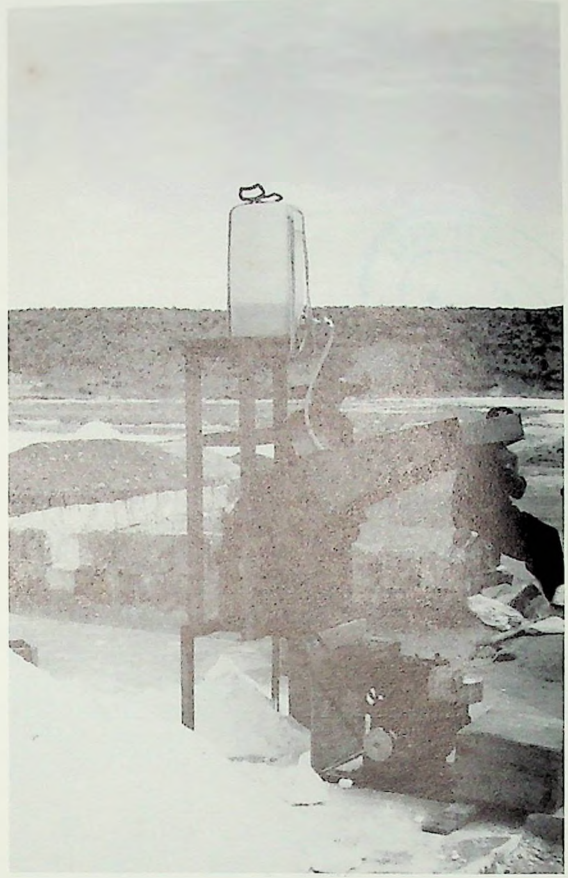
Other forms of iodine supplementation were used in the early stages of the Program. In 1985 Lugol's iodine, one drop each day, was distributed to pregnant woman and preschool children throughout the country, but the coverage was not further evaluated. Approximately 225,000 people received some iodine in this form. Several campaigns with iodized oil took place, the first in 1983, a second in 1986 and the third in 1988. The latter provided iodine to about 1,200,000 inhabitants in 4,800 communities (*IDD Newsletter* 4(4):1, November, 1988). Subsequently, another 196,000 doses have been given, with only several thousand each year recently.

A major part of the campaign has been education and social communication. These activities have been described previously in the *Newsletter*. The Program aimed materials about IDD and the benefits of its treatment to all levels, facilitated by many collaborators both in governmental and nongovernmental organizations and in all regions. By the current year, evaluations in the most deprived zones of the country demonstrated that knowledge of iodized salt was greater than 95%.

Initially, epidemiologic surveillance was based solely on thyroid size. The 1981 survey reported a national goiter prevalence of 61%, and a repeat survey in 1983 found 65%. In both, all departments of the country had extensive goiter, the lowest prevalence in 1983 being 56%. A survey in 1989 of 25,830 children, six to eight years old, reported an overall goiter prevalence of 20.6%, ranging from 11.3% in Potosi to 38.9 in Beni. In 1994, a survey confined to 30 clusters with a sample of 360 reported a national goiter prevalence of 4.5%. However, because of uncertainties in accuracy of palpation in these small thyroids in children, a further review comparing palpation among several endocrinologists and ultrasonography left the matter unsettled. All agreed that the goiter prevalence had greatly decreased from that reported in previous surveys.

Education has been a key component of the program. The previous articles document the extent and innovation of this activity. Examples included brochures and other literature directed at many different levels, fiestas, radio shows, videos, and numerous oral presentations.

A brief survey of a small number of students taken from each



COURTESY E. SCHOFFELIN/UNICEF

*Salt iodization by simple technology on site in Bolivia.*

part of the country reported a goiter prevalence of 4.5% in 1994 and a median urinary iodine excretion of 19.4 µg/dl, with adequately iodized salt in 90% of samples taken at the consumer level.

## Current Status

In preparation for the external evaluation, PRONALCOBO conducted a national survey (the Multiple Indicators Study), completed in August 1996, on the consumption of iodine and the content of iodine in urine in 100 clusters, 70 in urban zones and 30 in rural zones. Twenty-five households in each cluster were sampled, a total of 2500 households nationwide. The survey found that consumption of iodized salt was 92% overall in the country, 85% in rural areas and 98% in urban. This was an increase from the Demographic and Health Survey of 1994 (DHS/94), which showed an iodized salt consumption of 64% in rural areas and 91% in the urban.

The current survey measured urinary iodine in five samples from each cluster, for a total of 500 samples. The results showed a median urinary iodine excretion of 25.2 µg iodine/dl, and an average of 20 µg iodine/dl. In urban and rural regions, 98% of the values were over 10 µg/dl. Nationally, 81% of the urinary iodine levels were greater than 10 µg/dl, and only 9.2% were below 5 µg/dl. In distribution among the departments, Chuquisaca had 70% of the households using iodized salt, and a median urinary iodine excretion of 16.8 µg/dl. All other median urinary iodine excretions were above 20 µg/dl.

Current data indicate that approximately 70,000 metric tons of salt are produced per year. Of this, iodized salt comprised 53,579 metric tons in 1995. This amount provides enough for 19 grams iodized salt per person per day and makes the country more than sufficient in availability of iodized salt for the average salt consumption. Beginning with 14 iodization plants in 1986, the number has grown steadily to the present 54, all of them private and independent. By department these are distributed among La Paz (11), Oruro (31), Uyuni (4), Cochabamba (6) and Sucre (2). Of the 17,000 metric tons per year of non-iodized "common salt," 20% is block salt, another 20% granular salt, and the remaining 60% rock salt. Iodization of block salt has been a long interest in the Bolivian program, and large scale iodization of blocks has begun in Uyuni and Coipasa. Consumption of block salt by humans has decreased notably in the past five years and its use is confined mainly to animals.

## Application of Guidelines for IDD Elimination

The Guidelines for Assessment of Progress towards IDD Elimination, proposed by ICCIDD (*IDD Newsletter* 11(2):19, May 1995) recommended that at least two of three criteria should be met to establish current iodine sufficiency. One, that adequately iodized salt is available and consumed by more than 90% of the population, appears to be met in Bolivia. Another, that the median urinary iodine excretion be greater than 10 µg/dl, is also satisfied. These two conditions establish iodine sufficiency by the ICCIDD guidelines. A third criterion, that goiter prevalence is less than 5%, is not clearly established in Bolivia, although the decrease in thyroid size by palpation has diminished dramatically during the course of the program.

ICCIDD has also offered guidelines for assessing sustainability. We can apply these to Bolivia as follows:

1. *Existence of an effective national IDD program* - Continued monitoring of iodine content of salt is in place. The DHS study is a recurring international program that is next scheduled for Bolivia in 1997-98. It carries out careful household surveys, and in the most recent effort included taking of salt samples and information on salt use. It is recommended that urinary iodines also be incorporated in this or other surveys, to provide a biological marker for continuous follow-up. This guideline called for continuous monitoring including mandatory public reporting at regular intervals. If properly implemented, the DHS survey can satisfy this recommendation; otherwise, specific periodic surveys should be undertaken.
2. *Awareness* - Currently the Government, private sector, and consumers in Bolivia have a high awareness of iodine deficiency and appear committed to its sustained elimination.
3. *Salt industry* - The guideline called for the industry's commitment, technical resources, and responsibility to the sustained and effective iodization of salt. Currently, the industry is doing this. Improvement in quality control and technology were recommended by the external evaluators, because much of the current methodology is fairly primitive, and the iodization, while adequate, is not well controlled.
4. *Iodine supply* - This appears satisfactory under current conditions.
5. *Cost and benefits* - A key feature in any successful program is that consumers are motivated to prefer iodized salt. This recommendation is probably met currently in Bolivia. Non-iodized salt is more difficult to obtain, and its price is only slightly less than the iodized product ($0.18 compared to $0.20).
6. *Laboratory access* - Current lab facilities in La Paz are satisfactory for urinary iodine determination, and probably adequate for salt iodine measurement both in La Paz and elsewhere in the country.

## Conclusion

The external evaluating committee commended Bolivia for its dramatic progress from severe iodine deficiency to its current level of iodine sufficiency. The country has met the ICCIDD guidelines for iodine sufficiency and the prospects for sustainability appear good. Areas for improvement include better quality control and technology of the salt iodization. Also, while animals are probably receiving iodized salt, and iodized salt is probably part of food processing, both of these areas deserve more attention. As with all countries, monitoring must take place regularly in future years to ensure permanence of IDD elimination. ■

*"I encourage all people to demand iodized salt in the marketplace; all governments to assure that iodized salt is regularly available to all people; all salt producers to support efforts to eliminate iodine deficiency in this manner. This will help to ensure a bright future for the health and development of your future generations."*

— DALAI LAMA

*(Full statement on page 49)*

# Eleventh Annual ICCIDD Board Meeting

The 1996 meeting took place in several stages. Fifteen Board members met in Harare, Zimbabwe, April 25-27 in conjunction with the Conference on Sustainable Elimination of IDD in Africa by the year 2000 (reported in previous issue of the *Newsletter*), including Asuquo, Bailey, Benmiloud, Delange, Egbuta, Hetzel, Lantum, Ling, Mannar, Mutamba, Ntambue, Pandav, Siandwazi, Thilly, and van der Haar. Special observers and guests were B. Underwood (WHO), A. Verster (WHO/EMRO), and C. Ciupek (Guerbet). A follow-up teleconference was held shortly afterwards, hosted by PAMM in Atlanta, with Delange, Maberly, Dunn, Pretell, and Stanbury, as a step towards making communication among Board members more efficient. Improved methods of telecommunication make this approach feasible, and it has the great advantage of saving both money and time that would be required for a full Board meeting. The Executive group of ICCIDD will continue to meet annually in the fall, this year scheduled for Ottawa in late October. Additionally, the increasing availability of electronic communications through e-mail and the Internet greatly facilitate information exchange. Activities in this direction are discussed elsewhere in this issue.

Dr. Hetzel, ICCIDD Board Chairman, presided at the Harare meeting and Dr. Delange, Executive Director, at the later teleconference. Items on the agenda included: reports of activities of the Executive during the past year, considerations for future activities; reviews of regional activities; reports of special advisory committees on science and technology, salt technology, communication, and liaison; publications; future meetings; reports of the nominating committee; and review of financial status.

Many of these items have already been addressed in previous issues of the IDD Newsletter and are not repeated here. Others will be described in further reports in a forthcoming issue. The following paragraphs present additional highlights.

**Reports of Executive Directors** - Dr. Hetzel and Dr. Delange reported that the transition of office of the Executive Director in mid 1995 from Australia to Belgium had proceeded smoothly, and they are working closely together in their current roles, as Chairman and Executive Director, respectively. Dr. Delange reviewed his activities including production of documents, letters to Regional Coordinators, publications, independent evaluations, the multicenter study in Africa, statements on iodine-induced hyperthyroidism, field work in Europe and Africa, the ThyroMobil project, and visits and contacts with the European Union, UNICEF and WHO (both at their respective headquarters and many regional and country offices), the SCN of the ACC, private industry, particularly Guerbet and Merck, Kiwanis in France, Belgium, Monaco, and approach to bilaterals in Belgium, Germany, and Switzerland.

**Discussion of ICCIDD orientation for next three years** - ICCIDD noted the remarkable progress that has been made towards the goal of sustainable elimination of IDD. It has contributed to the success by its network of over 400 professionals in 82 countries, by its technical and scientific support to governments, professional bodies and agencies, and by its transfer of technology to affected countries, thus enabling them to become technically independent in managing their IDD programs.

ICCIDD recognizes that the biggest push will be towards achieving sustainable IDD elimination by the year 2000, and continues to dedicate all its efforts to this goal. It also recognizes that the sustainability will require constant monitoring and availability of technical support, both for countries that still have not attained that goal and for others that having attained it, need regular monitoring to prevent recurrence of iodine deficiency.

For the next three years ICCIDD, in coordination with agencies, wants to intensify its action in its specific fields, particularly technical and scientific expertise and research, focussing on monitoring at all levels to ensure sustainable elimination, as well as information, communication, and education, and liaison with other agencies involved in the same process. ICCIDD plans to expand its already close links with its collaborative allies, particularly the Micronutrient Initiative and PAMM. The directors of both of these groups were early members of the ICCIDD Board, and have remained on it after the subsequent creation of their respective organizations. ICCIDD recognizes the importance of these links in achieving the common goal of sustainable elimination of IDD.

Dr. Delange outlined some key components of ICCIDD's proposed global program for the next three years. These included:

1. **Identification of countries with IDD and inadequate programs** - This has been a major activity of ICCIDD since its inception, in collaboration with WHO, UNICEF, and other partners. New information continues to appear and progress is being constantly updated.
2. **Independent evaluation** - ICCIDD has prepared a short bulletin with recommendations on steps to be taken for independent evaluation of country progress towards IDD elimination. Components of this statement have already been published in the *IDD Newsletter* (11(2):19, May, 1995). ICCIDD has already been invited to participate in independent external evaluations of country programs in Paraguay, Bolivia, Peru, the African multicenter study and several countries in Southeast Asia, among others. With the rapid progress in IDD programs during the past five years, and the approach of the year 2000, this will be one of the most important activities for ICCIDD in the next several years. Equally important is the provision of a framework for continued monitoring by countries in the years following 2000. Veterans of the IDD scene will ruefully recall the promising initial achievements in IDD control a generation ago that subsequently lapsed because methods for permanent monitoring were not installed.

   ICCIDD is continuing its efforts to coordinate data on progress in countries and technical issues. The CIDDS (Current IDD Status) database project has been described in earlier *Newsletters.* It was developed by ICCIDD in coordination with WHO and UNICEF, by Dr. Jonathan Gorstein and Dr. John Dunn, with extensive input from regional coordinators in ICCIDD and agencies, particularly UNICEF and WHO. Financial support has come from USAID, initially through its IMPACT program and currently through OMNI. Dr. Gorstein has also been responsible for developing databases for the MDIS of WHO in

Geneva and databases for vitamin A and iron for the Micronutrient Initiative. Currently CIDDS IV is available via the Internet of the MI (http://www.idrc.ca/mi/mnnet.htm) with last updating in June 1996. Drs. Gorstein and Dunn are currently updating this (CIDDS V) under contract with OMNI, in close collaboration with the MI. ICCIDD is establishing its own home page on the Internet (see announcement elsewhere in this issue). This will house CIDDS V, a technical database with text from the *IDD Newsletter* (IDDTECH), and information about ICCIDD and IDD in general.

3. **Operational research** - An independent evaluation of water iodination as a means for correcting iodine deficiency is underway, headed by Dr. Benmiloud, ICCIDD Vice Chairman. His group has completed a review of existing water iodination reports from Malaysia, Italy, Thailand, Mali, China, the Central Africa Republic, and Sudan. Interviews are being conducted with some producers of iodinators, and field studies are being undertaken in two African countries and two Asian countries where iodized water has been used. In each, information will be obtained about: the population coverage with iodized water; the iodine intake and goiter prevalence of the target population; technical information on various iodinators including their availability, installation, maintenance, cost to the community and the household; reliability of iodine supply under field conditions; capacity of the community to maintain water iodization systems; the acceptability of the iodized water and its cost by the community; and the accessibility of iodized salt. The review and data will permit Dr. Benmiloud's group to compare water iodization with other preventive measures, particularly iodized salt, for efficiency, cost, acceptability, maintenance, monitoring and sustainability. This study is being funded by the Canadian International Development Agency through the Micronutrient Initiative.
   b. *Evaluation of the impact of IDD correction on intellectual and socioeconomic development* - Development of such a study is being considered, and funding sought.
   c. *Development of a screening test for field urinary iodine determination* - As has been pointed out before, urinary iodine is the major laboratory indicator for iodine nutrition. While simple quantitative laboratory methods exist and have been evaluated and modified by ICCIDD (*IDD Newsletter* 9(4):40, November, 1993), semiquantitative methods that are faster, cheaper, and applicable in the field are needed. Several groups are actively interested in pursuing this technical development, which ICCIDD strongly encourages.
   d. *Further integration of neonatal thyroid screening as an index of adequacy of iodine deficiency correction* - This project is being pursued by several Board members including Maberly, Thilly, van der Haar, Benmiloud, and Delange.
   e. *Technical evaluation of test kits for determination of iodine levels in salt* - The roles of pH, alkalinity, and type of starch are being investigated. Mr. Mannar, the MI, PAMM, and ICCIDD, in close collaboration with UNICEF, are pursuing this project.
4. **Collaborative projects** - The following are identified as joint projects for collaboration with others, particularly PAMM, the MI, and WHO, as well as other agencies.
   a. Identification of countries with IDD projects but without current implementation and equipment.
   b. Identification and implementation of regional reference laboratories.
   c. Joint publications on technology and policy guidelines.
   d. Training and capacity building, and reinforcement of regulations with the salt industry.
   e. Networking on micronutrients.
5. **Communication and education** - Dr. Ling reviewed activities during the past year. In advocacy/promotional activities, these included launching the first IDD Day with MI, UNICEF, and Kiwanis, the ICCIDD/Animation Award entries with results sent to UNICEF, and promotion of a global iodized salt logo. In the area of the communication/education clearing house, the Focal Point produced and distributed the second version of *Clearinghouse Notes*, put in a bibliographic database. It also produced the consultant flyer in English, French, and Spanish, the IDD Fact Card, and proposed an IDD progress information presentation service.

Future actions were discussed at the meeting. They include: (a) contribution to the next IDD Day; (b) art competition on IDD themes involving schoolchildren as an effective method of public participation and education; Dr. Ling will pursue this possibility with groups such as UNESCO; (c) a proposed publication "Countdown 2000" which will have country spotlights; Dr. Ling will pursue this project with Regional Coordinators and relate it to existing information systems within ICCIDD, such as the CIDDS database, and develop proposals for funding; and (d) development of an IDD module for school health curricula in countries. The programs should include school health education that involves training of teachers and the incorporation of sections on IDD in curricula.

**Regional activities** - The annual reports of the Regional Coordinators were reviewed. Information from these has been given in previous issues of the *IDD Newsletter*. Additionally, Dr. Ntambue noted that in Zaire, the Ministry of Trade in 1995 adopted the regulation that all imported salt should be iodized, with inspection by the National Office of Quality Control at the port of entry. During the Multicenter Study, four sites were visited, of which three had more than 94% of the salt iodized and urinary iodine levels above 10 µg/dl. Additional urine samples are being analyzed.

#### Publications and reports

1. **SOS for a Billion** - The Conquest of Iodine Deficiency Disorders, Second edition, edited by Hetzel and Pandav is now available for $20 individual copy or $15 per copy for bulk orders. Drs. Hetzel or Pandav can be contacted for ordering information. A French translation is being planned.
2. **Introduction to the ICCIDD** - This recent update was printed, and some 1600 copies already distributed. It is planned to make this also available on the ICCIDD home page on the Internet.
3. **Iodine Nutrition in Pregnancy** - Most manuscripts have been gathered for this publication, to be edited by Drs. Stanbury, Delange, Dunn, and Pandav, and printed by the Oxford University Press in Delhi, the latter by negotiation with Dr. Pandav.
4. **Social Mobilization for IDD** - The Board recognizes the need for a handbook on the social mobilization aspects of IDD programs, including advocacy at the sub-national level, public education, and stimulating demand for iodized

salt at the community level. Drs. Ling and Lantum, with PAMM, will explore this need.

5. **IDD Newsletter** - The editor, Dr. Dunn, filed a report. Four issues appear each year, for a total of 60-64 pages. Approximately 4200 copies are printed, distributed either in bulk or by individual subscription. Approximately 80% go to developing countries. Funding currently comes from the ICCIDD core budget. The OMNI program of USAID has offered to contribute and this is being negotiated. Issues for the last five years are being introduced onto ICCIDD's website on the Internet and may become available by disk as well.
6. **ICCIDD Monthly Update** - This sheet of 1-3 pages is issued at the end of each month by the Secretary, Dr. Dunn, and distributed by e-mail, fax, or mail to Board members and others who have expressed interest. More than half of the Board members can be accessed via e-mail, and the list grows steadily. While developed initially as a means for steady communication among Board members, it is also sent to key agency officials and others with an interest in IDD who have requested receiving it. It will also be included on ICCIDD's website.
7. **ICCIDD manual series** - Some 50,000 copies of *The Practical Guide to Iodine Deficiency* were printed in English in 1990 and most supplies have been exhausted. The Spanish and French translations are also nearly exhausted. Copies are still available in Portuguese. This manual, has been widely distributed by direct mail and through international agencies. The manual *Salt Iodization for the Elimination of Iodine Deficiency*, by Mannar and Dunn, is available for distribution from the MI, the ICCIDD Secretary's office, WHO, or UNICEF. The manual *Methods for Measuring Iodine in Urine* is also available.

**Liaison activities** - The Board reviewed its extensive contacts with other groups, particularly those by Dr. Delange, Dr. Hetzel, Mr. Haxton, and Dr. Benmiloud, with World Health Organization, the Subcommittee on Nutrition of the United Nations Administrative Coordinating Committee, the World Bank, Kiwanis, UNICEF, OMNI, bilateral donors, and many other organizations. Regional Coordinators also pursued local contacts with agencies and nationals involved in IDD or its correction. The Board re-emphasized its strong commitment to coordinating its activities with all relevant groups.

**Election of Board members and Senior Advisors** - The accompanying list gives the composition of the new Board. New members of the Board for 1996 include: **J. Egbuta**, public health scientist (Nigeria); **L. Locatelli-Rossi**, salt consultant (South Africa); **L. Meftah**, salt consultant (Algeria); **Sangsom Sinawat**, government nutrition physician (Thailand). The following Board members with expiring terms were renominated: **Bailey, Djokomoeljanto, Medeiros-Neto, Mutamba, Ntambue, Pinchera, van der Haar.** New Senior Advisors include **R. Aquaron**, scientist (France); **R. Carriere**, UNICEF (Bangladesh); **N. Chawla**, communications specialist (India); **O. L. Ekpechi**, endocrinologist (Nigeria); **G-F. Fenzi**, endocrinologist (Italy); **G. Gebre-Medhin**, pediatrician (Sweden); **R. Hanneman**, Salt Institute (USA); **S. Ouais**, physician (Syria); **R. Prakash**, Salt Commissioner (India); **R. Trowbridge**, CDC/PAMM, nutrition physician (USA); **B. Underwood**, nutritional scientist (WHO); **P. Vitti**, endocrinologist (Italy); **R. Volpe**, endocrinologist (Canada). ■





# ICCIDD 1996

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# The Control of IDD in Zimbabwe

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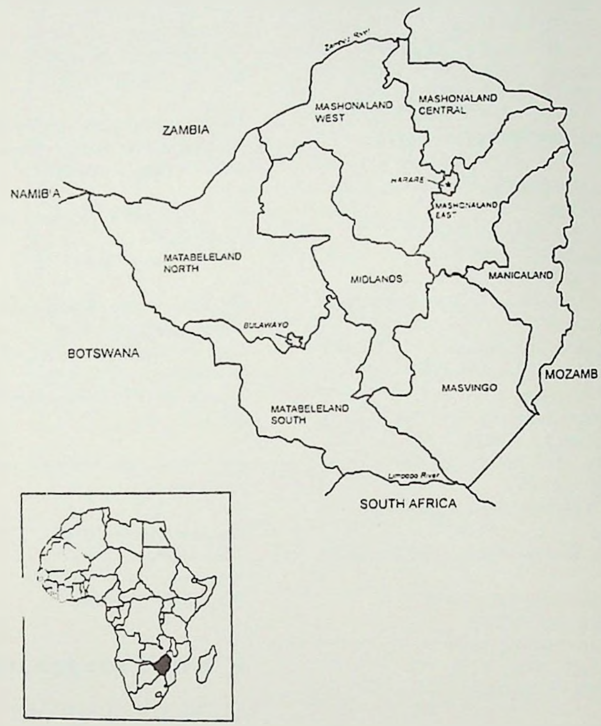
Zimbabwe is a landlocked sub-Saharan African country situated between the Zambezi and Limpopo rivers (see map, Figure 1). It is thus south of the Equator and entirely within the Tropic of Capricorn. Zimbabwe's neighbors are Zambia to the north, Mozambique to the east, South Africa to the south and Botswana to the west. Most of the country is on the Central African plateau at altitudes of 900 meters or more above sea level. Granite, schists and igneous rocks make up more than 70% of the country's area.

The total surface area of Zimbabwe is 390,757 km2, and population around 11.5 million. Around one third of the population live in urban areas. Greatest population densities (apart from cities) are found in the east and north, and lowest in the west. The country is divided into 8 provinces plus the two main cities.

Zimbabwe is classified as a lower middle income country (1994 per capita GDP was US$438). It has a well developed infrastructural network of roads and railways. The principle sources of national wealth are agriculture, mining and tourism. Tobacco is the single biggest foreign exchange earner, but horticulture is of growing importance. In recent years Zimbabwe has been a net importer of maize, the main staple food, after a succession of poor seasons. In 1996, after good rains, the country is expecting to once again start exporting maize. Many different minerals are mined: among the most important are gold, chrome, iron, copper, asbestos and platinum. There are no substantial salt deposits in Zimbabwe and all salt is imported.




*Map of Zimbabwe to show provinces.*

## IDD in Zimbabwe

A variety of words for goiter exist in the local languages of Zimbabwe, suggesting that it has long been recognized by indigenous African people. Published accounts of goiter first appeared in the 1960s. In the most detailed of these, Dent and co-workers reported finding a total goiter rate of 76% amongst 356 subjects of all ages, with a high frequency of clinical nodularity.[1] Prevalence was highest in the 6-10 and 10-20 year age groups. One subject was suspected of being hypothyroid and no cretinism was observed. Water in a local well and stream was analyzed for iodide levels: these were 1.13µg/L and 0.90µg/L respectively. Although these levels were recognized as being very low, the authors suggested that goitrogens, particularly from the Brassica family, may also be playing an important role.

Political events during the 1970s overshadowed any attempts to tackle endemic goiter, but after Independence in 1980 interest in the problem was rekindled. Grave and Mills reviewed the notes of all admissions with a principal diagnosis of thyroid disease to Mpilo Hospital, Bulawayo for the years 1969-77.[2] They concluded that in 64% of the 418 cases dietary iodine deficiency was the main cause of the disease, and made a strong plea for legislation on the iodization of domestic salt.

A study in Goromonzi District reported a goiter prevalence of 29%, although this may have been an underestimate.[3] Urine iodine results were probably misleadingly high, but no role for goitrogens was suggested. Eight of 229 subjects tested were hypothyroid and two hyperthyroid. One hundred infants under one year old had TSH estimation carried out on filter paper whole blood samples: all were in the normal range. A study in Hwedza district found a total goiter rate of 73% overall - very similar to the figure found in the same schools 18 years earlier.[4] Despite this very high figure, a community survey of 7,000 people in the same area revealed only five (0.07%) who had lesions consistent with cretinism.[5]

A decisive role for iodine deficiency in the etiology of endemic goiter in Zimbabwe was only recently established.[6] Median urine iodine concentrations in Hwedza and Chiweshe districts were 10µg/L and 16.5µg/L respectively: results consistent with severe iodine deficiency. Goitrogens that are metabolized to thiocyanate were found to have no significant effect. Figures 2 and 3 show respectively subjects with goiter and a cretin from these two districts.

As part of a later study in Goromonzi district, thyroid function testing was performed on schoolchildren, showing raised

TSH levels in 35% of the 188 children tested.7 Audiometry on this same group showed that all but one of the 121 children tested had normal hearing indicating an absence of subclinical cretinism, despite the high frequency of hypothyroidism.8

By the beginning of the current decade, the picture had become fairly clear. Endemic goiter occurred in many parts of Zimbabwe, and was severe in some localities. Iodine deficiency had been established as the main etiological factor, with little apparent role for goitrogens.

## 1988 National Goiter Survey

Despite the evidence from some parts of the country that severe IDD did occur, its importance as a public health problem was disputed. In order to resolve this question, and to determine whether a national IDD control program was justified, in 1988 the Ministry of Health carried out a national goiter survey. With the support of the Swedish International Development Agency (SIDA), teams from all provinces were trained in goiter survey techniques and surveys took place in all provinces towards the end that year.

Thyroid size was estimated according to standard methods as recommended by WHO. Surveys took place in primary schools with the aim of covering 1% of the total population of each district. Schools were selected according to a locally developed method of sampling on a population proportionate-to-size basis, similar to that described in "Monitoring Salt Iodization Programs."10 Total and visible goiter rates were derived on a district-by-district basis.

Altogether 53 districts were surveyed. A province-by-province summary of the results is shown in Table 1 - these data have been weighted by population size utilizing the results of the 1992 census.9 The survey confirmed that endemic goiter affected the whole of Zimbabwe to a greater or lesser extent: no district had a total goiter rate of less than 10%. In other words, the whole of Zimbabwe was affected by some degree of iodine deficiency. Twenty of the surveyed districts were judged as being severe endemia on the basis of total goiter rates (TGR) above 50%. The most severely affected province was Mashonaland East: it includes the worst affected district, Murehwa, where total and visible goiter rates were 79% and 23% respectively. The least affected provinces were Matebeleland South and the two major cities, Harare and Bulawayo. Overall, 6.4 million people - more than half the total population of Zimbabwe - were at risk of moderate or severe IDD.

*Zimbabwe has achieved virtual elimination of iodine deficiency within a very short period.*

## Establishment of a National IDD Control Program

In 1989, following the national goiter survey, the Ministry of Health called a national consultative meeting of all the interest-

**Table 1: Summary of results of 1988 national goiter survey: Weighted data by providence**

| Providence | Population (1992) | Total Examined | TGR% | VGR% | Severity of IDD |
|---|---|---|---|---|---|
| Manicaland | 1,537,224 | 22,373 | 42.7 | 2.8 | Moderate |
| Mashonaland Central | 856,736 | 17,133 | 51.9 | 5.0 | Severe |
| Mashonaland East | 1,034,342 | 14,144 | 59.5 | 10.3 | Extreme |
| Harare | 1,485,615 | 9,824 | 10.8 | 0.2 | Mild |
| Mashonaland West | 1,112,955 | 20,727 | 41.4 | 1.3 | Moderate |
| Masvingo | 1,222,581 | 24,549 | 51.2 | 5.4 | Severe |
| Matebeleland North | 641,186 | 16,263 | 38.8 | 1.6 | Moderate |
| Bulawayo | 621,742 | 4,663 | 19.3 | 0.4 | Mild |
| Matebeleland South | 592,398 | 14,834 | 16.6 | 0.7 | Mild |
| Midlands | 1,307,769 | 19,586 | 42.5 | 3.6 | Moderate |
| **Zimbabwe overall** | **10,412,548** | **164,096** | **38.3** | **3.3** | **Moderate** |

TGR = Total goiter rate

VGR = Visible goiter rate

**TERMS OF REFERENCE OF THE ZIMBABWE INTERSECTORAL COMMITTEE ON IDD CONTROL**

1. To define the plan of action for the IDD control program.
2. To assign tasks to the various Ministries and sectors.
3. To monitor the implementation of the IDD plan of action.
4. To assist in the distribution of iodized oil capsules as a short term strategy for the control of IDD in severely affected areas.
5. To ensure the availability of iodized salt as a long term strategy for the control of IDD.
6. To formulate mechanisms for monitoring and evaluation.
7. To identify relevant research areas.
8. To draw up a project proposal for the Zimbabwe IDD control program.
9. To suggest effective mechanisms to sensitize communities on IDD and foster meaningful community participation in the control program.
10. To facilitate the enacting of appropriate legislation for the control of IDD.
11. To work out mechanisms for involving NGOs and the international agencies in the IDD program in Zimbabwe.

ed parties to discuss the results and to plan strategies for the elimination of IDD in Zimbabwe. The meeting recommended that a national intersectoral committee be established to oversee IDD control, with representation from a variety of Ministries - including Health, Trade and Commerce, Finance, Agriculture, Information and Justice; the University of Zimbabwe, and the bilateral agencies. The terms of reference for this committee are given in the Box.

The committee is chaired by the director of the Maternal and Child Health (MCH) unit within the Ministry of Health. The secretariat is located in the Departmental of National Nutrition, and the Deputy Director of Nutrition is the coordinator of the national IDD control program.

In addition to the main committee and the secretariat, three subcommittees were established as working parties. These are: (a) monitoring and research; (b) salt iodization, and (c) social mobilization.

The national consultative meeting set a variety of objectives for IDD control. These were later refined by the national intersectoral committee and incorporated into the national plan of action which was adopted in 1991. The overall goal of the national IDD control program, as stated in the plan of action is *"to eliminate iodine deficiency disorders in Zimbabwe by ensuring normal iodine nutrition of the entire population by the year 2000"*.

The main method recommended was universal salt iodization, with iodized oil capsule distribution as an interim measure for severely affected areas. A broad intersectoral and interministerial approach to addressing the IDD problem was recommended, through the following strategies: intersectoral collaboration; advocacy; social marketing; strategic intervention; surveillance, monitoring and evaluation; research and evaluation; and human and organizational development.

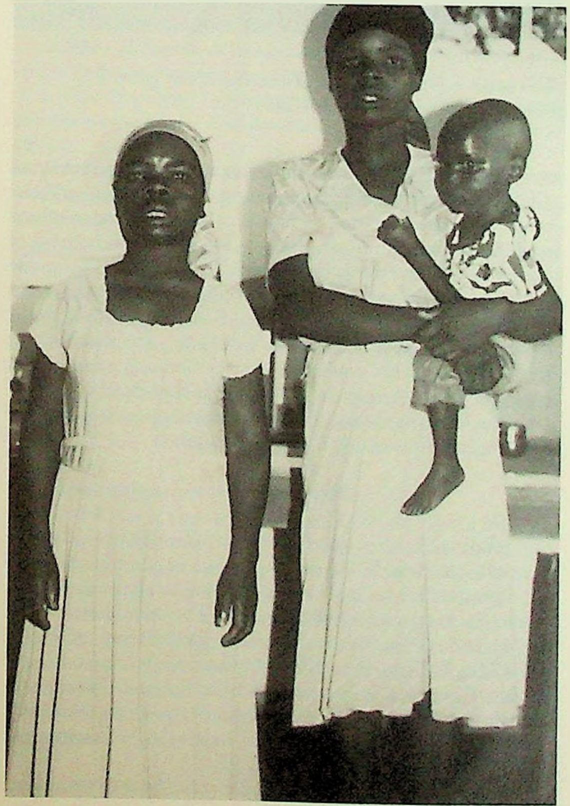
Three major achievements of the Zimbabwe IDD control program are highlighted: the attainment of USI, the creation of a partnership with the private sector; and the establishment of a comprehensive monitoring program.

## Universal salt iodization (USI)

USI always appeared the best option for IDD control in Zimbabwe. Salt, prepackaged into 500g to 2kg bags, is distributed throughout the country by traders, who sell it through retail outlets. All but a tiny amount of salt is imported, and packaged locally. In the late 1980s, four companies handled 80% of all salt imports.

Sensitization on the need for iodization of salt commenced after the formation of the national intersectoral committee, with local politicians and the salt traders particularly targeted. (Figure 4 shows a poster used in efforts to raise the awareness of the general public on the issue.) International pressure for action was also growing, particularly following the World Summit for Children in 1990. Included in the plan of action adopted by heads of state was the virtual elimination of IDD by the year 2000. The President of the Republic of Zimbabwe, Robert

*(Above) Women with visible goiter. (Right) Cretin, left, with normal woman and her child.*



Mugabe, was present at the United Nations for this summit.

The importance of the Sua Pan project in Botswana was realized at an early stage. Sua Pan is a large salt pan which was developed for the large scale commercial production of soda and salt. In early 1991, at a meeting of the Africa IDD Task Force in Dar es Salaam, a resolution was passed urging the managing company to produce iodized salt. This was followed up with a salt producers' workshop held in Botswana in 1993.

As a result of all these and other efforts, increasing quantities of iodized salt were produced and imported into Zimbabwe from 1992 onwards. The law governing salt in Zimbabwe was finally amended in early 1995. The new regulations specify that:

> *"all salt that is manufactured or sold for human consumption, whether as crude salt, table salt, flavored salt or otherwise... shall be iodated with potassium or sodium iodate and contain the equivalent of not less than thirty milligrams or more than ninety milligrams of iodine per kilogram of salt."*

Recent data shows that nearly all of Zimbabwe's salt is now iodized to some degree, with only 2% of 335 samples collected in 1996 having less than 10 ppm iodine. However, 33% of samples still did not meet the lower legal limit of 30 ppm. (1986 sentinel surveillance data - see below).

## Partnership with the private sector

Private and non-governmental organizations have participated in the Zimbabwe IDD control program from its inception, particularly the salt importers (all private companies) and the Consumer Council of Zimbabwe. These organizations were


*IDD poster - The caption, in Shona, translates "goiter is preventable: always use iodized salt."*

actively involved in policy formulation and the implementation of USI. Once the need for importation of iodized salt had been recognized, traders started to import it well in advance of any legal requirement to do so. Recognizing the health benefits of iodized salt, traders put it on sale at little or no extra cost to the consumer (less than 5% more than non-iodized salt). The major supplier of iodized salt, SodaAsh (Botswana), realizing the potential commercial advantages, agreed to sell iodized salt at the same price as the equivalent type of non-iodized salt. This partnership with the private sector, which has helped to provide iodized salt at affordable prices, should also greatly strengthen the prospect of sustaining USI in the future.

## Monitoring

As indicated above, monitoring was identified as a key element of Zimbabwe IDD control program at an early stage, and the subcommittee on monitoring and research has met regularly since its formation in March 1990. The committee's membership includes representatives from the Ministry of Health and Child Welfare (Nutrition, Epidemiology Environmental Health, Government Analyst and Blair Research Laboratory); the Ministry of Agriculture (Veterinary Services); the University of Zimbabwe (Biochemistry, Chemical Pathology and Community Medicine), and UNICEF.

The main function of this committee has been to set in place a mechanism to monitor the biological effects of iodine supplementation, and to make recommendations to the main committee on any changes needed. To this end, 12 sentinel districts were chosen. These represent a cross section of urban and rural, remote and proximal, and previously severe and mild IDD areas. In each of these districts, three schools are randomly selected for annual visits by the survey team. The main method selected for monitoring has been urine iodine analysis on spot samples collected from school children. At least 50 samples are collected in each school from children who are selected by systematic random sampling from the total enrollment of the school. Goiter surveys are carried out at the same time. Survey teams in the provinces were originally trained for the national goiter survey in 1988, and follow up training workshops have been held since.

Urine iodine assays are established at the Government Analyst Laboratory (GAL) and the University of Zimbabwe Department of Biochemistry. The GAL has the main responsibility for routine analysis of urine iodine. Staff there attended one of the training courses held at the Program Against Micronutrient Malnutrition (PAMM) in Atlanta, and the laboratory participates in the PAMM quality control scheme.

Facilities for TSH monitoring on filter paper samples are available, and neonatal testing is being carried out on a trial basis in selected districts. However, due to staffing difficulties and the expense of the method, measurement of TSH has yet to become established as a routine part of Zimbabwe's monitoring system.

Salt monitoring, which is carried out countrywide, also forms a major component of the Zimbabwe IDD control program. Environmental health officers from all provinces have now been trained in the use of rapid test kits for monitoring salt at household, retail and wholesale level, and a reporting system for results has also been established. According to available records, around 5,000 salt samples were tested in 1995. When a batch of salt is found to be inadequately iodized on kit testing, samples are sent to the GAL for formal analysis by titration before action is taken. In addition, salt monitoring with analysis by titration has now been incorporated into the program for monitoring the effects of the social dimensions of the economic structural adjustment program, providing a regular countrywide snapshot of the quality of salt on sale.

## Changes in iodine status

Local assays for iodine levels in urine were established in Zimbabwe by 1990. Early results confirmed the findings (reported above) from outside laboratories, and underlined how severe and widespread iodine deficiency was in Zimbabwe. Prior to the implementation of USI, in 1990-92, typical median urine iodine (UI) levels amongst primary schoolchildren were around 20-50μg/L. For example, in Chimanimani district (Manicaland) median UI was 19.5μg/L, Murehwa (Mashonaland East) 22μg/L, Centenary (Mashonaland Central) 24μg/L, Binga (Matebeleland North) 51μg/L, Bikita (Masvingo) 31μg/L, Gokwe (Midlands) 59μg/L, Matobo (Matebeleland South) 37μg/L and Harare City 50.5μg/L. Such results broadly confirmed the findings of the 1988 goiter survey - and indicated that moderate to severe iodine deficiency occurred throughout the country, even in cities.

By 1993, obvious change in urine iodine was already apparent. For example, in that year Chimanimani and Centenary districts had median UIs of 283μg/L and 228μg/L respectively. Extensive urine collection under the monitoring program took

**Table 2: Typical changes in iodine status which have occurred in a previously severely affected district since 1990**

| Year | Median urine iodine (µg/L) |
|---|---|
| 1991 | 20 |
| 1993 | 280 |
| 1995 | 430 |

place in 1995. The overall median UI on all samples collected from 6 districts was 430µg/L (range of medians: 290-560µg/L) and mean 490µg/L. What is remarkable is that of all 966 samples analyzed, only 16 (1.7%) had values below 50µg/L and 48 (5.0%) below 10µg/L. These results indicate that all the children surveyed were receiving an adequate amount of iodine.

While it is indisputable that most of the change in iodine status is due to the implementation of USI, there have also been some dietary changes over the same period. In recent years there has been a considerable increase in intake of sea fish, notably mackerel, following the signing of a trade agreement with Namibia. Annual per capita fish consumption rose from 2.66kg in 1992 to 6.35kg in 1994.[11] This probably equates to an average daily intake of about 15µg iodine per day. However, since fish consumption is variable, some individuals may be getting as much as 100µg of iodine from this source.

Table 2 summarizes the typical changes in iodine status which have occurred, in previously severely affected districts, during the current decade.

Little data on the changes in the occurrence of the manifestations of IDD, such as goiter, are available, but a small study in one locality showed a drop in total goiter rate from 44% to 9%.

## Current challenges

These results are a testament to the success of USI, and suggest that IDD has already been eliminated in Zimbabwe. However, program managers still face a number of important and related challenges, notably:

(a) A rise in the incidence of hyperthyroidism since USI was implemented. Todd et al[12] described a threefold increase in the number of cases of hyperthyroidism seen at the central hospital in Harare between 1991 and 1994. Such an increase has been described in many countries in association with programs of iodine supplementation, and may to some extent be unavoidable. Although hyperthyroidism is a readily treatable condition, adequate facilities for this are required.

(b) From a state of iodine deficiency, Zimbabwe's population is now exposed to more iodine than needed to guarantee normal thyroid function. This may magnify any increase in hyperthyroidism and is therefore undesirable. The reasons for this state of over abundant supply are probably that salt consumption was underestimated and losses of iodine from salt were overestimated. Furthermore, there is enormous variability in the amount of iodine in the salt.

(c) Continuing to monitor iodine status. These experiences indicate the importance of an on-going program of monitoring as part of overall IDD control. While a salt monitoring manual is being developed for local use, resources and manpower are required to sustain the existing surveillance system.

## Conclusion

Zimbabwe has achieved virtual elimination of IDD within a very short period, an achievement of which we are justifiably proud, and a testament to the efforts of many people in government, the University, the international agencies and the salt trade. Some fine tuning is required, particularly with regard to the amount of iodine in salt, and continuing monitoring is essential. Indeed, a well established monitoring system is essential for the sustainability of the program, along with the continuing commitment of all the key players: politicians, salt traders, government ministries, non-governmental organizations and consumers. The benefits for future generations - in terms of increased school performance, increased work capacity, decreased goiter and so on - are likely to be enormous. ■

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### Acknowledgements


We wish to acknowledge all the members of the National Intersectoral Committee on IDD control and all its various subcommittees. In particular we wish to thank Mrs. Theodora Nyamandi from the Government Analyst Laboratory, Prof. Julia Hasler of the University of Zimbabwe, and Ms. Laura Maclehose and Dr. Peggy Henderson of UNICEF, Harare. This report contains some data prepared by the authors for the recent WHO seven country study on iodine status in Africa. Finally we wish we to thank the Secretary for Health and Child Welfare for permission to publish.

# Pattern of Salt Consumption and Awareness About Iodine Deficiency Disorders in Kashmir Valley

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## Introduction

The commitment of the South Asia Association for Regional Cooperation (SAARC) to eliminate IDD by the year 2000 is reflected in the declaration of "Universal Access to Iodized Salt by 1995" at the second SAARC Conference held in Colombo, Sri Lanka in September, 1992. Recently an extensive survey has revealed that Kashmir valley is an iodine deficient area with a very high goiter prevalence in schoolchildren (1). The present study assesses the pattern of salt consumption and awareness of iodine deficiency disorders by different socioeconomic groups in Kashmir valley.

## Study Population and Methods

We investigated 999 subjects from different socio-economic strata and from various areas of Kashmir valley (urban and rural). They were interviewed using a pre-planned questionnaire on salt consumption and on awareness of various aspects of iodine deficiency disorders. The study population included teachers, doctors, college students, businessmen and housewives chosen randomly from various areas of Kashmir valley. Literacy, socioeconomic status and urban/rural status of the study population was determined by Pareek's scale and modified Kuppuswamy scale (2).

IDD awareness was assessed by asking about goiter, its relationship to iodine deficiency, utility of iodized salt, etc. Salt consumption pattern was determined by asking about the type of salt consumed, source of salt, and storage of salt. We also visited various markets to assess the availability of different types of salt (coarse salt, rock salt, iodized salt, etc.).

## Results

Table 1 gives the details of IDD awareness in 999 subjects surveyed. From this table it is clear that; (1) most subjects had seen someone with goiter; (2) goiter was seen more frequently by subjects who were either rural, illiterate, or lower class; (3) only a small percentage of upper class literate and urban subjects replied that we should use iodized salt; and (4) a significant percentage of urban, literate, middle-upper class subjects knew the companies manufacturing iodized salt, primarily through television advertisements.

Table 2 has details of the types of salt consumed in rural and urban areas, and shows that: (1) most of the people in rural areas consume non-iodized salt; (2) only one-third of urban subjects preferentially and invariably use iodized salt; (3) a small percentage prefer rock salt; (4) one-third of urbanites do not seem to care about the type of salt they should use; and (5) people from rural areas seem to prefer coarse salt.

Table 3 records the pattern of salt consumption in various socio-economic classes, and shows that: (1) most of the people from the lower class consume coarse salt;' (2) only one-fourth of the upper class take iodized salt; and (3) collectively, all classes predominantly consume coarse salt.

*Continued on page 48*

*An elderly hukka-smoking Kashmir shopkeeper dealing with non-iodized salt.*

*A young businessman selling non-iodized salt in the main market of Srinagar, the capital city.*

**TABLE 1**
**AWARENESS OF IODINE DEFICIENCY DISORDERS (IDD) IN 999 SUBJECTS SURVEYED**

| Variable | Males n=639 | Females n=360 | Urban n=375 | Rural n=624 | Literate n = 645 | Illiterate n=354 | Lower class n=258 | Middle class n=579 | Upper class n=162 |
|---|---|---|---|---|---|---|---|---|---|
| 1. Have you seen a person with goiter? | 540 (84.5) | 282 (78.33) | 354 (94.4) | 510 (81.73) | 579 (89.76) | 285 (80.50) | 228 (88.37) | 504 (87.04) | 132 (81.48) |
| 2. Is it seen in your area? | 291 (45.53) | 159 (44.16) | 111 (2.93) | 339 (54.32) | 228 (35.34) | 222 (62.71) | 120 (46.51) | 303 (52.33) | 33 (20.37) |
| 3. Do you know its cause? | 75 (11.73) | 15 (4.16) | 60 (16) | 30 (4.80) | 90 (13.95) | 0 (0) | 12 (4.65) | 45 (7.77) | 33 (20.37) |
| 4. What is iodized salt? | 36 (5.63) | 9 (2.5) | 30 (8) | 15 (2.40) | 45 (6.97) | 0 (0) | 6 (2.32) | 24 (4.14) | 15 (9.25) |
| 5. What salt should we use? | 168 (26.29) | 42 (11.66) | 162 (43.2) | 48 (7.69) | 210 (32.55) | 0 (0) | 33 (12.79) | 123 (21.24) | 54 (33.33) |
| 6. If. iodized why? | 30 (4.69) | 6 (1.66) | 24 (6.4) | 12 (1.92) | 36 (5.58) | 0 (0) | 6 (2.32) | 18 (3.1) | 12 (7.40) |
| 7. What is iodine content of salt? | 3 (0.469) | 0 (0) | 3 (0.8) | 0 (0) | 3 (0.46) | 0 (0) | 0 (0) | 3 (0.51) | 0 (0) |
| 8. Companies that manufacture iodized salt? | 165 (25.82) | 30 (8.33) | 102 (27.2) | 93 (14.90) | 195 (30.23) | 0 (0) | 18 (6.97) | 129 (22.27) | 48 (29.62) |

Table entries show numbers of positive or correct responses (% in parentheses).

**Table 2. Pattern of salt consumption in rural versus urban population**

| Type of salt used | Urban Population n = 375 | Rural Population n = 624 | Total population n = 999 |
|---|---|---|---|
| Coarse | 81 (21.6) | 564 (90.4) | 645 (64.6) |
| Rock | 39 (10.4) | 12 (1.9) | 51 (5.1) |
| Iodized | 114 (30.4) | 6 (1.0) | 120 (12.0) |
| Both iodized and non-iodized | 141 (37.6) | 42 (6.7) | 183 (18.3) |

Table entries are numbers of people, with percent of total in parentheses.

**Table 3. Pattern of salt consumption in various socio-economic classes**

| | Socio-economic Class | | |
|---|---|---|---|
| Type of salt used | Lower Class n = 258 | Middle Class n = 579 | Upper Class n = 162 |
| Coarse | 210 (81.4) | 381 (65.8) | 54 (33.3) |
| Rock | 15 (5.8) | 27 (4.7) | 9 (5.6) |
| Iodized | 9 (3.5) | 69 (11.9) | 42 (25.9) |
| Both iodized and non-iodized | 24 (9.3) | 102 (17.6) | 57 (35.2) |

Table entries are numbers of people, with percent of total in parentheses.

### Discussion

This study has shown that there is little awareness about IDD in the general population in this valley, although the area has significant manifestations of iodine deficiency. In order to eliminate IDD, iodine needs to be introduced into the daily diet. Items regularly consumed include salt, bread, sweets, milk, sugar, and water. Among these, salt has been universally accepted for iodization because almost all sections of a community consume it irrespective of economic level. Salt intake is particularly high in this valley because people use it instead of sugar with tea. There is supposed to be a total ban on the sale of non-iodized salt in Jammu and Kashmir (3). However, market survey revealed non-iodized salt is freely available throughout Kashmir valley (Figures 1 and 2). In fact, there are businessmen exclusively engaged in the sale of non-iodized salt. Some grocers also offer iodized salt, particularly in Srinagar, the capital city, and in some major towns. However, the amount of this salt that is actually sold seems quite small because of the common man's preference for the coarse non-iodized salt.

From this study we conclude that we are far from achieving IDD elimination by the year 2000. The official agencies appear to have no will to implement the already existing total ban on non-iodized salt, and this lack is compounded by inadequate awareness regarding the magnitude of the IDD and its alleviation through salt iodization at the levels of policy making and implementing, medical professionals, the salt sector and general public. Lack of awareness in a dual market where both iodized and non-iodized salt compete leads the population (especially the rural poor) understandably to choose non-iodized salt even if it is only marginally cheaper. Correcting this situation requires strong political commitment and industry motivation supported by effective and continuous monitoring to make only iodized salt available. However, at present it appears unlikely that we are anywhere near elimination of IDD in this valley. ■

*Lack of awareness in a dual market leads the population (especially the rural poor) to choose non-iodized salt even if it is only marginally cheaper.*

### References

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2. Mahajan BK, Gupta MC 1991 Social environment. In: Mahajan BK, Gupta MC (eds), Textbook of Preventive and Social Medicine, first edition. Jay Pee Brothers Medical Publishers Pvt. Ltd., New Delhi, pp 82-87.

3. Ministry of Industry. Banning sale of edible non-iodized salt - n urgent measure. Produced by The Salt Department, Ministry of Industry with support from UNICEF, 1995.

# Success of USI in Madhya Pradesh - A Follow-Up

An article in the *IDD Newsletter* (11(4), 46, Nov. 1995) on Madhya Pradesh's (MP) program to sustain IDD elimination, based on reports from **Dr. C. S. Pandav**, ICCIDD Regional Coordinator, and **Ms. Nilima Chawla**, ICCIDD Board member, described the "Mission Approach," for an all-out push against IDD. This approach has clear objectives and strategies to handle a public issue, within a defined time frame by a committed team. The Rajiv Gandhi Mission for Elimination of Iodine Deficiency Disorders, launched in August 1994, was one of seven in Madhya Pradesh. Its objectives were to ensure availability of adequately iodized salt in all villages and towns of the State by the end of 1997 and to increase awareness of the population on the importance of iodine and IDD.

The previous article described the program and the intensive effort to assess IDD and test salt for iodine content. After the first year, the Mission reported that more than 84% of the salt consumed in the State was iodized. Since the Mission appeared to be successful in its goal, a date in 1996 for its closure was set by the Chief Minister, who also stated that "the closure will be preceded by an independent evaluation to be conducted by a reputed nongovernment evaluation agency." This led to an invitation to ICCIDD to provide this independent evaluation. For this, Dr. Pandav headed a large team for planning and coordination, laboratory assessment, field survey, data management, and report preparation.

*As a result of the Mission, almost all homes used iodized salt.*

The evaluation focussed on the proportion of urban and rural households in MP consuming adequately iodized salt, and the availability of iodized salt at the retail level in rural and urban areas. In addition, it assessed the awareness of the population about iodized salt and IDD. The field survey in November 1995, conducted by 20 physicians representing 12 national institutions and two international organizations, assessed 30 clusters from rural and urban populations. The teams collected salt samples from households and retail shops, and interviewed household members and shop keepers to assess their knowledge, attitude, practice and behavior about iodine deficiency and iodized salt.

The results showed that 98.4% of salt samples at the household level, were iodized. Their iodine content was adequate in 69% urban households, and 61% from rural ones. The inadequate levels of these samples might come from insufficient iodization at production level, and/or problems with packaging, storage, transportation, and repacking.

Awareness of issues about IDD and iodized salt was considered positive in 65% of urban households and 44% of rural ones. Major sources of information were health workers and television. The survey also noted that 88% of urban households consumed powdered salt while 32% of rural households used crystalline salt. Of the powdered salt samples, about 30% were inadequately iodized. Thirty-eight percent of the crystalline samples in rural households were adequately iodized, contrary to popular impressions. The retail shops in the sampled areas sold only iodized salt (> 97%). The levels of adequately iodized salt in shops was similar to that in households.

The evaluation team concluded that the Mission had been successful, and noted these specific achievements:

1. Involvement of the salt traders in implementing the universal salt iodization program. The "Bhopal Declaration" by the salt traders, in which they agreed to sell only iodized salt, was an important boost.
2. Forging partnerships between program managers and key stakeholders to understand the viewpoints of different sectors.
3. The involvement of Nagarik Apoorti Nigram, a service group, to make adequately iodized salt available, particularly in the remote areas.
4. The involvement of the district administration, health department, and education department to create awareness and promote monitoring.

The team emphasized the importance of a smooth transition to a "system approach," to gather the critical momentum needed for the program to progress on its own and achieve sustainability. In addition, they recommended that: (1) the program should continue to receive the same level of priority and urgency that it did during the Mission; (2) intersectoral coordination should be retained and preferably enhanced; (3) the efforts to obtain community participation must be continued and strengthened; (4) the Mission Director's role should be assumed by a responsible officer from one of the participating departments, which would then be responsible for further implementation of the program; and (5) the monitoring system should include social, regulatory, and health functions; social monitoring should be carried out in schools, communities, and consumer organizations, with spot testing of iodized salt and recording its price; the Directorate of Food and Drug Control should enforce existing regulations; health monitoring should include goiter prevalence and urinary iodine levels measured in school-age children every five years.

The evaluation team recommended that the success of this program should be widely publicized in the State and nation, as a model for implementing other health-related social development issues. The report concludes by emphasizing the need to sustain political statement that is bolstered by broad public understanding of issues. Key components are quality assurance and continued involvement of all relevant stakeholders. ■

# IN BRIEF . . .

■ **ICCIDD on the Internet** - A home page is being set up through the server at the University of Virginia. Components include: general information about ICCIDD, the Current IDD Status (CIDDS) database, and an IDD technical database (IDDTECH). The present address is "**http://avery.med.virginia.edu/~jtd/iccidd/**"; this may change. The CIDDS database contains summary information on IDD in each country. It has been available on disk and through the MI server for the past two years with periodic updating. The current edition, CIDDS 4 was completed in mid 1996, and the next, CIDDS 5, is scheduled for late 1996. IDDTECH is a technical database initially composed of the last five years of the *IDD Newsletter*, by flat text with indexing by country and subject. Dr. Jonathan Gorstein and Dr. John Dunn are carrying out this project, with financial support from the USAID-sponsored OMNI program and in coordination with the Micronutrient Initiative. Maintenance of entries will be carried out by ICCIDD with new information as it appears. For those without web access, these databases can be distributed by disk. Coordination of these activities with the MI and others will be discussed at the forthcoming Executive meeting in Ottawa.

■ **Dalai Lama Statement on IDD** - This statement, signed by the Dalai Lama, was issued on August 16, 1996. David Haxton, ICCIDD Board member, and others were instrumental in obtaining it, with particular reference to its usefulness in accelerating efforts to control IDD in Mongolia. The text is as follows:

*"It is the right of children to grow and develop to their full genetic potential. This requires that each receive appropriate amounts of micronutrients for the body and the brain to develop harmoniously. It is especially important to understand that minute amounts of iodine are vital to the normal growth and development of children. The absence of those amounts denies appropriate opportunity for growth of the brain. Children born to parents living in iodine deficient areas of the world, many millions in Central, East, and South Asia, are at risk of preventable mental retardation. Scientific studies reveal that iodine deficiency also is a cause of poor educational ability of children, as those living in iodine deficient areas have an IQ level about 13 points lower than that of children living in iodine sufficient areas. This can be prevented by the regular consumption of iodized salt in the daily diet in cooking, food preservation and food savoring. I encourage all people to demand iodized salt in the marketplace; all governments to assure that iodized salt is regularly available to all people; all salt producers to support efforts to eliminate iodine deficiency in this manner. This will help to ensure a bright future for the health and development of your future generations."*

■ **WHO Press Release on USI** - Following the review in Geneva in July of the multicenter study in Africa, attended by a number of ICCIDD members including Delange, Benmiloud, Braverman, Lantum, Todd, Vitti, and others, WHO released a statement, beginning with "..... the benefits of salt iodization by far outstrip potential adverse effects." Special attention was given to the cases of iodine-induced hyperthyroidism in Zaire and Zimbabwe. The report comments on the decrease in goiter and other beneficial effects of USI. It also noted that cases of hyperthyroidism had occurred in Zaire and Zimbabwe, but had not clearly been shown in Cameroon, Kenya, Nigeria, Tanzania, and Zambia, the other countries in the study. The press release attributed the cases of hyperthyroidism to unnecessarily high levels of iodization in the salt, partly due to lower losses and higher consumption than previously assumed, and partly to some batches of iodized salt containing levels of iodine higher than prescribed. Recommendations for better monitoring and quality control were made. The release also noted that some countries could safely lower salt iodine levels without reducing effectiveness. The statement called on governments to work closely with salt producers to further improve the quality of iodized salt. A report with the actual data is expected once its release is authorized by WHO. ■

# ABSTRACTS

**RELATION BETWEEN SERUM THYROTROPIN AND THYROGLOBULIN WITH URINARY IODINE EXCRETION.** *W. Buchinger, O. Lorenz-Wawschinek, G. Binter, W. Langsteger, R. Bonelli, O. Eber, Graz-Eggenberg, Austria.* The Thyroid and Iodine, *edited by J. Nauman, D. Glinoer, L. E. Braverman, U. Hostalek, published by Schattauer, Stuttgart. Merck European Thyroid Symposium, Warsaw, May 16-18, 1996, page 189.*

Styria has historically been iodine deficient. Iodized salt was introduced in Austria at 10 ppm KI and increased to 20 ppm in 1990. Between 1984 and 1990, the percentage of subjects with urinary iodines below 100 µg/dl dropped from 83 to 37%, probably because of improved education on the benefits of adequate iodine nutrition. No significant changes occurred after 1991. Six hundred eighty-two euthyroid patients on no thyroid medications were assessed by urinary iodine levels, TSH, and serum thyroglobulin. From the accompanying graph, TSH was at its lowest (1.25 µU/ml) with a urinary iodine between 200 and 300 µg/l and slightly higher, but still within the normal range, when the urinary iodine level was either greater or less. Serum thyroglobulin levels decreased progressively with increased iodine in urine. Assuming that low TSH and Tg values correspond with optimal iodine intake, the authors conclude such an intake should be approximately 250 µg/day.

**THE EFFECTS OF DIFFERENT DOSES OF ORAL IODIZED OIL ON GOITER SIZE, URINARY IODINE, AND THYROID-RELATED HORMONES.** *B. Elnagar, M. Eltom, F. A. Karlsson, A. M. Ermans, M. Gebre-Medhin, P. P. Bourdoux, University Hospital, Uppsala, Sweden. J Clin Endocrinol Metab 80:891-897, 1995.*

The authors gave single oral doses of iodinated oil (Lipiodol) containing either 200, 400, or 800 mg iodine to 117 adults with goiter in the Darfur region of western Sudan, an area of severe iodine deficiency, with an overall goiter prevalence of 80%, visible goiter 28%, and median urinary iodine 2 µg/dl. After 12 months, 13.8% of the 200 mg group had a urinary iodine concentration above 10 µg/dl compared with 27.3% of the 400 mg group and 35% of the 800 mg group. About 60% of the subjects in each group showed a reduction in thyroid size, by palpation. The median TSH for all subjects was normal before treatment and decreased in all groups. A few subjects had an increase in TSH about one week after oil administration. Four subjects, all females, three with thyroid nodules, showed evidence of hyperthyroidism, mostly in the first two months. The authors conclude that the dose of 200 mg iodine provides satisfactory control of iodine deficiency for one year, basing this conclusion on TSH response. This dose applies to adults and is lower than that recommended by Benmiloud, et al., for children.

**IS THERE A CASE FOR A PROTECTIVE "TREATMENT" OF IODINE DEFICIENCY GOITERS WHEN LARGE DOSES OF IODINE HAVE TO BE ADMINISTERED?** *G. Hintze, O. Blombach, E. Scharf-Bornhofen, J. Köbberling, Germany.* The Thyroid and Iodine, *edited by J. Nauman, D. Glinoer, L. E. Braverman, U. Hostalek, published by Schattauer, Stuttgart. Merck European Thyroid Symposium, Warsaw, May 16-18, 1996, page 192.*

A frequent clinical concern is whether large doses of iodine, such as in radiocontrast media, affect thyroid function in subjects from iodine-deficient areas. The authors performed thyroid function studies in 710 subjects undergoing coronary angiography. Two patients developed hyperthyroidism, as defined by a low TSH and increased T4. About 2% of subjects developed overt hypothyroidism, and up to 14% had transient subclinical hypothyroidism. The authors conclude that development of iodine-induced hyperthyroidism is an uncommon event following iodine loads in areas of moderate iodine deficiency.

**ALIMENTARY SUPPLY OF IODINE IN GERMANY.** *R, Hampel, T. Kühlberg, H. Zöllner, d. Klinke, K. Klein, E.-G. Pichmann, A. Kramer. Münch med Wschr 138:78, 1996 (in German).*

This study reports urinary iodine values from 5,932 volunteers with normal thyroids from 32 regions of Germany. The median value was 72.4 µg/g creatinine; 76.9 µg/g in children and 71.9 µg/g in adults. Nine percent were over 150 µg/day, 17% were between 100 and 150; 55% were between 50 and 100; 17% between 25 and 50; and 2% were below 25 µg. There were no significant differences between the former East Germany and West Germany, nor among different regions of the country. The authors conclude that despite voluntary measures that include evolution of trade barriers within Europe, information campaigns, and removal of restrictive laws, iodine deficiency continues in Germany. They recommend laws for iodine prophylaxis.

**THE USE OF SUGAR AS A VEHICLE FOR IODINE FORTIFICATION IN ENDEMIC IODINE DEFICIENCY.** *M. Eltom, B. Elnagar, E. A. Sulieman, F. A. Karlsson, H. V. van Thi, P. Bourdoux, M. Gebre-Medhin, University Hospital, Uppsala, Sweden. Int J Food Sci Nutr 46:281-289. 1995.*

The authors first surveyed sugar production and consumption in Sudan, noting the presence of five major plants, four government owned. They concluded that sugar consumption was uniformly distributed throughout the country without differences among socioeconomic groups. The mean daily intake ranged from 48 to 78 grams. They assessed several techniques for iodization of sugar including addition as a solution before crystallization or by spraying before drying. They gave iodinated sugar to 125 subjects in Khartoum (urinary iodine 4.9 µg/dl) and Kosti (2.6 µg/dl), the latter an area of severe iodine deficiency with a goiter prevalence of 55%. Eighty-two percent of the goitrous subjects showed a decrease in thyroid size. Urinary iodines increased to 14.4 µg/dl in Khartoum and 9.8 in Kosti after six months consumption of iodized sugar. No cases of iodine-induced hyperthyroidism were found. The authors note several advantages for iodization of sugar in Sudan, including economic feasibility, availability of plants and factories already in operation, a low initial cost for iodization, and a well-organized sugar distribution system. They conclude that iodized sugar deserves further study as an alternative approach in circumstances where sugar is widely available and salt iodization programs are still not well developed.

**SEMI-ANNUAL REPORT, IODIZED SALT SUPPORT FACILITY (ISSF), GOVERNMENT OF PAKISTAN IDD ELIMINATION PROJECT, JANUARY-JUNE, 1996.** *I. Zafar, Islamabad, Pakistan.*

IDD in Pakistan has been reviewed many times in the IDD Newsletter, most recently in May 1996. The initial goal of 80% of salt being iodized by the end of 1996 has been pushed back to the end of 1998. However, one goal of Salt Marketing Pakistan (SMP), that at least 75% of salt processors initiate salt iodization, was achieved in 1995. In addition, household consumption of iodized salt increased from 2% in 1994 to 19% by August 1995, and to an estimated 30% by the end of 1995.

The report notes some stalling of the program during the first half of 1996. Contributing factors included the high price of iodized salt and its low availability in rural areas, inadequate funding for SMP, and rumors linking family planning to iodized salt. Also, achieving federal legislation for iodized salt has been delayed, and the iodized salt logo has not yet been registered. However, there has been progress. Currently, over 80% of salt producers are iodizing at least part of their output. Iodized salt sales in June 1996 showed an upward trend over those in May.

In the salt industry, the first half of 1996 showed a decrease in the number of salt producers by about 100, to approximately 520 currently. Noniodized salt continues to be available. Salt producers have recently been more willing to accept the subsidized price for $KIO_3$. The report identifies lack of enforcement and low market demand as principal issues and suggests that these need increased emphasis for the remainder of the year.

Education and communication activities also decreased, again attributed to nonavailability of funds and revision of the communication strategy. However, there has been increasing emphasis on local activity, particularly in rural areas. Recently, messages on iodine deficiency and the importance of iodized salt have been initiated for inclusion in the teaching in public primary schools.

**LEARNING DISABILITIES AND POOR MOTIVATION TO ACHIEVE DUE TO PROLONGED IODINE DEFICIENCY.** *B. D. Tiwari, M. M. Godbole, N. Chattopadhyay, A. Mandal, A. Mithal, Varanasi, India. Am J Clin Nutr 63:782-786, 1996.*

The authors compared 100 male children from a severely iodine deficient village to those from mildly deficient villages (mean urinary iodine concentration 2.8 µg/dl versus 5.7, $T_4$ 7.0 versus 9.6, and TSH 6.2 versus 4.9). Both groups were given psychological tests including maze, verbal, and pictorial learning and motivation. The severely iodine-deficient children scored significantly lower ($p < 0.01$) than the mildly deficient children. The authors interpreted these results as showing neural impairment as well as poor sociopsychologic stimulation resulting in learning disability and lowered motivation for achievement. They further concluded that unless iodine nutrition is improved, children such as these from iodine-deficient areas will not achieve their full potential even with adequate schooling opportunities.

**IODINE SUPPLEMENTATION IN SWEDEN AND REGIONAL TRENDS IN THYROID CANCER INCIDENCE BY HISTOPATHOLOGIC TYPE.** *B. Pettersson, M. P. Coleman, E. Ron, H. O. Adami, University Hospital, Uppsala, Sweden. Int J Cancer 65:13-19, 1996.*

The authors analyzed 5,838 cases of thyroid cancer in Sweden diagnosed between 1958 and 1981 to assess its possible relationship to iodine status. They found that iodine-deficient areas had a relative risk for developing thyroid cancer of 0.92 for all types, 0.80 for papillary cancer, and 0.87 for anaplastic cancer. The relative risk of follicular thyroid cancer in iodine-deficient regions was 1.98 in men and 1.17 in women. When examined by health care region, there was little variation among these six geographical areas in Sweden, leading the authors to conclude that iodization of the food supply was not associated with adverse trends in the occurrence of thyroid cancer.

**URINARY IODINE EXCRETION IN THE NORTHEAST OF PENINSULAR MALAYSIA.** *M. Mafauzy, W. B. Mohamad, M. Y. Anum, M. Musalmah, Universiti Sains Malaysia, Kelantan, Malaysia. Southeast Asian Journal of Tropical Medicine and Public Health 26:138-142, 1995.*

The authors examined 2,034 adults (over 15 years old) in the state of Kelantan. They compared regions near the coast with those more inland, with the former having a goiter prevalence of 31% and the latter 45%. The mean urinary iodine excretion was the same in the two regions (57 µg iodine/g creatinine). The authors concluded, on the basis of the goiter prevalence and urinary iodine, that this area of Malaysia is iodine deficient.

**IODINE CONCENTRATION IN CANTEEN MEALS PREPARED WITH OR WITHOUT IODIZED SALT.** *J. Linseisen, C. C. Metges, S. Schwarz, G. Wolfram, Universitat Munchen. Zeitschrift fur Ernahrungswissenschaft 34:240-242, 1995.*

The authors compared two university canteens differing only in that one used iodized salt for food preparation and the other did not. The relative iodine content of meals in the first canteen was 56.5 µg compared with 17 µg in the one without iodized salt, assuming a similar sodium chloride intake. They conclude that the use of iodized salt in eating establishments may play a more important role than previously recognized.

**THE EFFICACY OF IODINE PROPHYLAXIS IN THE PREVENTION OF ENDEMIC GOITER IN THE SOUTHWESTERN AREA OF ASTURIAS.** *A. Enguix, I. Riano, O. Larrubia, R. Gomez de la Torre, C. Rey, J. Otero, I. Pinto, Hospital Narcea, Asturias, Spain. Anales de Medicina Interna 12:182-186, 1995.*

Iodized salt was introduced into this Spanish region 10 years ago. The authors studied 317 school age children chosen randomly. The goiter prevalence was now 16.4%, compared with 63% previously. The mean urinary iodine excretion increased from 53 μg iodine/g creatinine to 106. However, while salt iodization has been generally effective, pockets of iodine deficiency remain.

**THE INSTABILITY OF DIETARY IODINE SUPPLY OVER TIME IN AN AFFLUENT SOCIETY.** *C. Als, K. Lauber, L. Brander, D. Luscher, H. Rosler, University of Bern, Switzerland. Experientia 51:623-633, 1995.*

The authors studied several groups of adult subjects in Bern, Switzerland. The mean urinary iodine excretion in healthy volunteers was 87μg/g creatinine. Previous estimates in the 1980's had indicated urinary iodine levels greater than 100 μg iodine/g creatinine. The authors conclude that iodine intake in this affluent society has been unstable and attribute it to modifications of eating habits including a reduction in total salt consumption. They also note the increased consumption of foods from other countries, prepared with salt containing little or no iodine.

**DECREASE OF INCIDENCE OF TOXIC NODULAR GOITER IN A REGION OF SWITZERLAND AFTER FULL CORRECTION OF MILD IODINE DEFICIENCY.** *B. L. Baltisberger, C. E. Minder, H. Burgi, Burgerspital, Solothurn, Switzerland. Eur J Endocrinol 132:546-549, 1995.*

Switzerland has gradually raised the levels of iodine in the salt over decades. In 1980 the iodine content was increased from 7.5 to 15 ppm, with an accompanying increase in mean urinary iodine excretion from 90 to 150μg/g creatinine. The authors reviewed the incidence of hyperthyroidism during these years, and found a 27% rise in the first year but thereafter a steady decrease to reach a level in 1988 that was only 44% of that in 1980. The decrease was principally in toxic nodular goiter (down 73%) rather than in Graves' disease (down 33%). The authors conclude that except for a brief initial increase in hyperthyroidism, correction of mild iodine deficiency gives a long range decrease in the incidence of hyperthyroidism. ■

## RECENT PUBLICATIONS

1. *SOS for a Billion - The Conquest of Iodine Deficiency Disorders*, 2nd edition, Oxford Press, Delhi, 1996, edited by B. S. Hetzel and C. S. Pandav - A nontechnical overview by ICCIDD of current information on IDD and the efforts to eliminate it. Available from the Oxford Press or from ICCIDD.

2. *Micronutrient Laboratory-Equipment Manual*, by Warwick May, PAMM - Contains specific details on supplies for setting up laboratory methods for micronutrients, including iodine in urine and salt. Available by writing PAMM, Emory University, 1518 Clifton Road, N.E., Atlanta, GA 30322, USA.

3. *Sharing Risk and Reward: Public-Private Collaboration to Elimination Micronutrient Malnutrition*, sponsored by PAMM, MI, OMNI - Reports on conference in Ottawa, December 1995. Available from MI or PAMM.

4. *Desordenes por Deficiencia de Yodo (D.D.Y.).* Una Vision Contemporanea, by Julio Cesar Carrillo, Facultad de Medicina, Universidad Nacional de Colombia, Bogota, 1995 - A very brief overview of IDD, with particular reference to Colombia. In Spanish.

5. *Eliminacion de Desordenes por Deficiencia de Yodo (D.D.Y.). Plan de Capacitacion y Divulgacion*, by Julio Cesar Carillo, Universidad Nacional de Colombia, Bogota, 1996 - A summary of the national plan for education and dissemination of information about IDD in Colombia. In Spanish. ■

**ICCIDD** INTERNATIONAL COUNCIL FOR CONTROL OF IODINE DEFICIENCY DISORDERS

The International Council for the Control of Iodine Deficiency Disorders (ICCIDD) is a nonprofit nongovernmental organization dedicated to the sustainable elimination of iodine deficiency throughout the world. Its activities are supported by donations from CIDA, UNICEF, the World Bank, SIDA, AIDAB, the Netherlands Ministry for Development Cooperation, USAID, the World Health Organization, and others. Inquiries about membership in the ICCIDD should be directed to the Executive Director, Dr. Delange.

The *IDD Newsletter* is published quarterly by ICCIDD and distributed free of charge in bulk by international agencies and also by individual mailing. The *Newsletter* welcomes comments, new information, and relevant manuscripts. Inquiries and subscription requests should be sent to the Editor, Dr. Dunn. Communications about different geographical regions can also be directed to the respective Regional Coordinators.

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**IDD NEWSLETTER**

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# Sustaining Elimination of Iodine Deficiency Disorders in South Asian Countries



Dr Chandrakant S. Pandav

28th Annual PHA Conference
29 September - 2 October 1996
Perth, Western Australia

PUBLIC HEALTH ASSOCIATION OF AUSTRALIA INC
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The International Council for Control of Iodine Deficiency Disorders (ICCIDD) is a non-profit non governmental organization dedicated to the sustainable elimination of Iodine Deficiency Disorders (IDD) throughout the world. The ICCIDD was granted an official status as an International NGO at the 47th World Health Assembly held in Geneva in 1994. It's activities are supported by donations/grants from the Australian Agency for International Development (AusAID), the Canadian International Development Agency (CIDA), the Micronutrient Initiative (MI), the Netherlands Ministry for Development Cooperation, the Swedish International Development Agency (SIDA), the United Nations Children's Fund (UNICEF), the United States Agency for International Development (USAID), the World Bank, the World Health Organization (WHO), and others.

**TO THE GLOBAL PARTNERSHIP DEDICATED TO THE ELIMINATION OF IODINE DEFICIENCY DISORDERS**

***An Ancient Scourge of Mankind***

The People of the affected countries
The Governments of the affected countries

The Salt Producers of each country

The International Agencies-especially
The World Health Organization
The United Nations Children's Fund
The World Bank

The Micronutrient Initiative
Program Against Micronutrient Malnutrition

Kiwanis International

The International Expert Network of
International Council for Control of
Iodine Deficiency Disorders
(ICCIDD)

The Bilateral Agencies especially
The Australian Agency for International Development
The Canadian International Development Agency
The Netherlands Ministry for Development Cooperation
The Swedish International Development Agency
The United States Agency for International Development

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ISBN 81-86813-06-3

Printed at Sona Printers Pvt. Ltd. B-181 Okhla Ph-1, New Delhi - 20.

## Contents

## Acknowledgements

A major portion of this paper constituted a Background Note prepared for the,"Third SAARC Ministerial Conference on Children of South Asia" held at Rawalpindi, Pakistan in August 1986. I would like to thank UNICEF-ROSA, Kathmandu for giving me the opportunity to prepare this note.

I am grateful to the Director, All India Institute of Medical Sciences (AIIMS), New Delhi for the constant encouragement and unstinted support given for all activities related to IDD elimination for the last 18 years. My thanks to all Faculty colleagues and staff of Centre for Community Medicine, AIIMS particularly Dr K. Anand, for their support for the work on IDD.

I gratefully acknowledge the support provided by the International Council for Control of Iodine Deficiency Disorders (ICCIDD) for carrying out IDD activities related to IDD elimination programmes in the Region. I am also thankful to Dr. Basil S. Hetzel, Chairman, ICCIDD and Dr. Francois Delange, Executive Director, ICCIDD and Board Members of ICCIDD for their inputs from time to time.

I was trained as an International Clinical Epidemiology Network (INCLEN) Fellow (Health Economics; Level - II), at the Department of Clinical Epidemiology and Biostatistics and Centre for Health Economics and Policy Analysis (CHEPA), at McMaster

University, Hamiltion, Ontario, Canada. I would like to place on record my acknowledgement to the INCLEN Programme.

Finally, I would like to express my most sincere thanks to the Public Health Education and Research Trust of the Public Health Association of Australia Inc for inviting me to be the International Health Orator for 1996, at the 28th Annual Conference of the Public Health Association, Perth, Australia. I consider myself very fortunate for the opportunity given to contribute to the conference theme on "Threats to Public Health: Challenges and Strategies."

## Abstract

### Sustaining elimination of Iodine deficiency disorders in South Asian countries

Iodine deficiency is the world's single most significant cause of preventable brain damage and mental retardation. The clinical and subclinical manifestations of iodine deficiency are collectively included in the term Iodine Deficiency Disorders (IDD) and affect all stages of human growth and development, from foetus to adult.

Regional cooperation in South Asian countries in IDD Control dates back to 1985. Since then Joint Inter-country Consultations and Workshops have been regularly held (1985, 1989, 1990, 1991, 1995).

The commitment of the South Asian Association for Regional Cooperation (SAARC) to eliminate IDD by the year 2000 is reflected in the declaration of Universal Access to Iodised Salt by 1995 at the second SAARC conference held in Colombo, Sri Lanka in September 1992.

Considerable progress has been made in the SAARC countries towards the elimination of IDD. Based on the experience so far, it is now time for member countries to consolidate the progress made so

far, share the experiences amongst one another and together draw out a future strategy focusing on sustaining the elimination of IDD in their respective countries and in the SAARC Region.

History teaches us that the sustained elimination of IDD requires constant vigilance of a range of professional and public interests. It is particularly important to understand this as we have crossed the target of universal iodisation of edible salt by the end of 1995. Too many of us may diminish our efforts when we reach the first plateau. The long climb to eliminate the stealthy scourge of IDD from the globe begins with achievement of universal iodisation of salt.

The future agenda for sustainable elimination of IDD should include continuous political and financial commitment, clear communication strategy, quality control measures, monitoring and tracking biological progress; and ensuring that the management process is in place to carry out these activities.

# 1

# Context and Perspective of Iodine Deficiency Disorders (IDD)

## IDD - A major public health problem

Iodine deficiency is the world's single most significant cause of preventable brain damage and mental retardation[1]. The clinical and subclinical manifestations of iodine deficiency are collectively included in the term Iodine Deficiency Disorders (IDD) and affect all stages of human growth and development, the fetus, the neonate, the child and adolescent, and the adult in the whole population. The adoption of the term IDD which was suggested by Hetzel in 1983 reflects a new dimension of understanding the full spectrum of the effects of iodine deficiency[2]. All these effects can be prevented by correction of iodine deficiency.

## IDD and the girl child

It is a well known that IDD and goitre are more common in females, specially during puberty, pregnancy and lactation[1]. Lack of iodine can cause irreparable harm even before birth. Mothers who are deficient in iodine may have frequent abortions and give birth to stillborn babies. The children born to such mothers are at a greater risk of dying during the first year of life. Those who survive can be permanently crippled with varying degrees of mental handicap and physical deformity commonly referred to as endemic cretinism[3].

**IDD and educability**

Iodine deficient children suffer from tardy concentration, impaired co-ordination and sluggishness, which results in poor school performance. In addition, their energy and productivity are also adversely affected. It has been estimated that, on an average, school children living in iodine deficient areas have an IQ level, about 13 points lower than the children living in iodine sufficient areas[4]. Thus, the total accumulated loss to each country is formidable.

**International commitments for IDD elimination**

On the occasion of the World Summit for Children at the United Nations in New York in 1990, attended by 71 Heads of State and 159 Governments, one of the specific goals adopted by the governments was the virtual elimination of IDD by the year 2000. To achieve that goal, it was subsequently agreed that all countries would iodise at least 95% of salt supplies for each country by the end of 1995[5].

Following the World Summit, a Policy Conference on Micronutrient Malnutrition 'Ending Hidden Hunger' was held in Montreal (10-12 October 1991), with full participation by the Board of the International Council for Control of Iodine Deficiency Disorders (ICCIDD)[5]. The goal of elimination was also included in the Plan of Action adopted by the International Conference on Nutrition (Rome 1992)[5].

At the recently concluded session of the World Health Assembly in Geneva in May 1996, the Resolution of the Executive Board of the WHO on, " Prevention and control of iodine deficiency disorders", was unanimously supported by the Member countries[6].

**Regional commitments for IDD elimination**

Regional cooperation in IDD Control dates back to 1985. Since then Joint WHO/UNICEF/ICCIDD Intercountry Consultations and Workshops have been regularly held in the South Asian Region in the years 1985, 1989, 1990, 1991 and 1995[7].

The commitment of the South Asian Association for Regional Co-operation (SAARC) to eliminate IDD by the year 2000 is reflected in the declaration of 'Universal Access to Iodised Salt by 1995 at the second SAARC conference held in Colombo, Sri Lanka in September 1992[7].

The targets for IDD control in the south-east Asian region are that by 1995, all countries with an IDD problem will have ongoing national IDD programmes and goitre rates will be below 20 per cent. By the year 2000, the regional aim is to have goitre rates no more than 5 per cent.

**Benefits and risks of iodine supplementation programmes**

The benefits and risks of iodine supplementation Programmes covering prevalence, population groups involved, health consequences and severity are presented in **Table - 1**[8].

The cost of salt iodisation is approximately 5 US cents per person per year - less than the price of a cup of tea. Using the most conservative estimates, the cost benefit ratio of IDD elimination programmes is 1:3[9]. If benefits related to education and livestock populations are included, the ratio would be 1:8. Thus, IDD elimination programmes provide a convincing opportunity of a worthwhile investment in improving the health and nutrition of populations.

**Table 1.** Benefits and Risks of Iodine Supplementation Programmes

| Description | Benefits of salt iodisation Programmes | Risks related to iodine supplementation |
| --- | --- | --- |
| Frequency of occurrence globally (Prevalence) | - 1,570 million living in areas at risk of IDD<br>- 655 million with goitre<br>- 43 million with preventable brain damage.<br>- commonest cause of preventable mental retardation. | Toxicity : Iodine supplementation only "unmasks" the subclinical stage of hyperthyroidism and is not responsible for its causation<br>- incidence of it is very low<br>- allergy : No case of allergy has been reported since 1974 |
| Population groups involved | - fetus, neonates, children and adolescents particularly girl child<br>- women in reproductive age group. | - toxicity : only people more than 45 years affected |
| Health consequences | - irreversible and untreatable | - temporary<br>- reversible on stoppage of iodine supplementation. |
| Severity | - reproductive failure-pregnancy wastage<br>- mental retardation | - minor symptoms (may even go unnoticed) |

## 2

# Current status of IDD Elimination Programmes

The total number of people and percentage of regional population living in areas at risk of Iodine Deficiency Disorders according to UNICEF Regions is given in **Table 2.**

**Table 2.** Total number of people and percentage of regional population living in areas at risk of Iodine Deficiency Disorders.

| UNICEF Regions | | | |
|---|---|---|---|
| UNICEF Region | Population (millions) | Population at risk (millions) | % of Global Total |
| East & Southern Africa | 261 | 90 | 5.7 |
| Central & Western Africa | 271 | 88 | 5.6 |
| Middle East & North Africa | 338 | 143 | 9.1 |
| East Asia & the Pacific | 1,724 | 557 | 35.4 |
| **South Asia** | **1,183** | **410** | **26.1** |
| Americas & the Caribbean | 444 | 168 | 10.7 |
| Developed / Industrialized | 1,217 | 116 | 7.4 |
| Total | 5,438 | 1,572 | 100.0 |

**Source:** WHO, Global Prevalence of Iodine Deficiency Disorders, published jointly by WHO, UNICEF and ICCIDD, 1993.

The prevalence of goitre, based on recent national surveys, current intervention strategy for IDD programmes, status of legislation recommending iodine content of salt at production and consumer level, estimated production of iodised salt as a proportion of total requirement and the estimated proportion of households consuming adequately iodised salt is given in **Table -3.** As is evident, considerable progress has been made in the SAARC countries towards the elimination of IDD. Based on the experience so far, it is now time for member countries to consolidate the progress made so far, share the experiences amongst one another and together draw out a future strategy focusing on sustaining the elimination of IDD in their respective countries and in the SAARC Region.

**Table 3.** Current status of IDD Elimination Programme in SAARC Countries

| No. | Country | Goitre Prevalence (Yr. of survey/resurvey) | Current intervention strategy for IDD Programme | Recommended Iodine Content of salt in parts per million (PPM) P = Production C = Consumer | Estimated production/ availability of iodised salt as a proportion of total requirement | Estimated proportion of households consuming adequately iodised salt |
|---|---|---|---|---|---|---|
| 1 | Bangladesh [10,11,12] | 47% (1993) | Iodised salt/ Iodised oil | P=50 c=N.A. | 62% | 34% (1995)# |
| 2 | Bhutan [13] | 18% to 46% (1992) | Iodised salt | P=60 C=30-50 | 95% to 97% | N.A. |
| 3 | India [14,15] | >10% (1994) | Iodised salt | P=30 C=15 | 60% to 70% | 61% to 69% (Madhya Pradesh) |
| 4 | Maldives [16] | 24% (1995) | Not yet introduced | P=Not yet C=Not yet | N.A. | 8% |
| 5 | Nepal [17, 18] | 55% (1992) | Iodised salt/ Iodised oil | P=30 C=N.A. | 87% | 50% |
| 6 | Pakistan [19, 20] | >10% (1994) | Iodised salt | P=50 C=15 | 80% | 30% |
| 7 | Sri Lanka | 19% (1989) | Iodised salt | P= > 50 C=25 | | |

## 3

# Future strategy for Sustaining Elimination of IDD

The following is the suggested agenda to consider for sustaining elimination of IDD in SAARC countries

### Political and financial commitment

There has been considerable political commitment for the elimination of IDD in the Region as well as in the Member countries. There is a need to continue the exercise on an on-going basis as the political and the administrative leadership keeps on changing. The advocacy efforts should now focus on the potential for achieving success in yet another public health programme following the eradication of small pox and near eradication of polio. Linked with this is the issue of making the required resources available to carry out the programme activities.

### Role of salt industry and technology

***Production and transportation of good quality common salt***

Bangladesh, India, Pakistan and Sri Lanka are self sufficient in production of common salt. Bhutan, Nepal and Maldives are importing common salt/ iodised salt primarily from India.

The following issues need attention so as to ensure good quality iodised salt.

**i) Quality of common salt**

In all the Member countries, there is a need to improve the quality of common salt. Technical capacity to do so exists in the Region.

**ii) "High visibility" for bilateral agreements between India and Bhutan, India and Nepal**

Presently Bhutan and Nepal are importing common salt from India. The agreements are between the a private salt trader from Bhutan and private traders in India and between Salt Trading Corporation, Kathmandu and private traders from India. There have been delays in providing common salt to these countries. There is a need to give "high visibility" to these agreements so as to receive the desired attention from the respective country representatives.

**iii) High visibility for bilateral agreements between India and Maldives**

Maldives has yet to introduce legislation on banning import of non-iodised salt. Maldives receives most of its salt requirement from private traders in Tamil Nadu, India. So far, no salt is produced in Maldives. There is therefore need to have an agreement between these two countries to provide good quality iodised salt to Maldives and, as in the case of Bhutan and Nepal increase the visibility of this agreement.

## Issues related to packaging and iodine retention in salt

### *Packaging*

To prevent iodine loss during storage and transport, there is a need for use of safe and protective packing by HDPE or LDPE bags weighing not more than 50 kgs so as to be in conformity with the International Labour Organization (ILO) recommendations. In places where purchasing of iodised salt is annual/ semi-annual, one should advocate the use of large LDPE bags rather than small packets. With the increasing concern of environmentalists about the use of polyethylene bags, there is a need for research to look for a bio-degradable yet protective material that meets the packaging requirements of consumers.

### *Iodine retention in salt*

Since there is no systematic and comprehensive information available on iodine retention in iodised salt under different conditions of iodisation, transportation and storage, there is an opportunity for the Member countries to develop a common protocol to answer this important operational research question.

## Legislation and enforcement

Except for Maldives, all the countries have passed legislation on production of iodised salt.

*Legislation to include salt for animal consumption*

Since IDD also affects livestock causing abortions, still births, decreased yield of milk,meat, eggs, wool etc., decreased capacity to work, there is a need to extend the ban to cover sale of non-iodised salt for animal consumption as well.

*Enforcement*

This is one of the weakest links in the Programme. Based on the experience in European countries, primarily of environmentalists, public interest litigations drawing the government's attention to availability of non-iodised salt in the market on a regular basis will be an important opportunity for community participation and involvement. Large scale distribution and use of rapid salt test kits will facilitate this involvement.

**Recognition of role of private sector in IDD elimination programme**

It is quite obvious from the above list that the private sector has played a key role in participating in a major public health problem of national importance. They are involved in production of common salt, adequate iodisation, packaging, transportation and marketing etc. The Member countries should now be explicit in recognising their contribution and have an on-going dialogue, not only to strengthen, but build on this successful "Public-Private sector" partnership for addressing micronutrient fortification of foods.

## Regional convention on common salt/iodised salt

As and when a member country requests for common salt/iodised salt, there should be clear instructions to mark the salt consignment as,"common salt for iodisation in that country" or "iodised salt for sale in that country". It is equally vital for the member country exporting to pass on these instructions to the concerned traders for strict compliance. The main objective of this exercise is to prevent sale of common salt in the respective countries, specially along the "soft" border areas.

## Assessment & monitoring : Tracking progress towards elimination of IDD

Different countries have at different times adopted different protocols for assessment and monitoring of IDD Programme. As a result it has not been possible to compare in-country as well inter-country data to assess the situation.

There is a need to sensitize the programme managers for using the WHO/UNICEF/ICCIDD recommended indicators of assessing IDD and its control so as to ensure uniformity.

## Community participation

No programme can be sustainable without community participation. NGO's, schools and consumer forums have an important role in continuing public pressure to ensure regular supply of good quality iodised salt for all times to come. This should therefore feature as a common agenda item. As mentioned earlier, large scale distribution and use of rapid salt test kits will facilitate this involvement.

**Capacity enhancement and Regional Co-operation**

There exists a network of institutions and individuals with the required experience and expertise to address the sustainable elimination of IDD. The key issue is of recognition of these and utilization of these resources. The following is the list of expertise which each country can contribute for capacity enhancement and co-operation in the Region.

| | |
|---|---|
| Bangladesh | : Laboratory management and Regional IDD Newsletter |
| Bhutan | : IDD assessment & Monitoring |
| India | : Salt industry and technology, Laboratory Management |
| Nepal | : Programme integration experience for iodised oil |
| Pakistan | : Social marketing |
| Maldives | : IDD assessment |
| Sri Lanka | : Community participation and NGO's |

**External evaluation**

As the Member countries achieve elimination of IDD there is a need for an external technical agency to carry out an independent assessment of progress towards sustainable elimination of IDD. Such an exercise has been recently completed by the State Government of Madhya Pradesh, India and Royal Government of Bhutan.

The Forty-Ninth World Health Assembly in May 1996 passed a resolution (WHA 49.13; Agenda item 17), unanimously adopting the resolution on the "Prevention and Control of iodine deficiency disorders".

In the resolution, item 4,"REQUESTS the Director-General:

(1) to continue to monitor the incidence and prevalence of iodine deficiency disorders;

(2) to reinforce the technical support provided to Member States, on request, for monitoring progress towards the elimination of iodine deficiency disorders with the help of the International Council for Control of Iodine Deficiency Disorders, other non-governmental organizations and UNICEF, as required;

(3) to mobilize additional technical and financial resources to permit those Member States in which iodine deficiency disorders are still a significant problem, for training health and development workers in the early identification and treatment of iodine deficiency disorders and develop or expand their appropriate public health preventive programmes for the elimination of these disorders;

(4) to establish a mechanism for verifying the elimination of iodine deficiency disorders in the world;

(5) to report to the Health Assembly by 1999 on progress achieved in the elimination of iodine deficiency disorders.

# 4
# Conclusion

History teaches us that the sustained elimination of IDD requires constant vigilance of a range of professional and public interests. It is particularly important to understand this as we have crossed that target of universal iodisation of edible salt by the end of 1995. Too many of us may diminish our efforts when we reach the first plateau. The long climb to eliminate the stealthy scourge of IDD from the globe begins with the achievement of universal iodisation of salt[24].

The strategy for management of sustained IDD elimination should, therefore, focus on the following essential elements:

- Continuous political and financial commitment.
- Clear communications strategy between professionals and the public.
- Persistent quality control processes to assure a high quality product, i.e. iodised salt with appropriate iodine levels.
- Monitoring and tracking biological progress with respect to IDD status with requests for independent assessment of the progress.
- Ensuring that the management process is in place to carry out these activites.

Basil Hetzel in his inaugural address at the South Asian Country meeting on "Partnership to End Hidden Hunger - Collaboration of stakeholders in sustaining elimination of Iodine Deficiency Disorders in Bangladesh", held at Dhaka, Bangladesh in April 1995 stated that, "The elimination of IDD will be a great triumph in the field of public health, comparable to the eradication of smallpox". This is eminently possible. For, there are few moments in time when there is a clear fork in the path of major human endeavour. As we battle against the ancient and pervasive scourge of iodine deficiency, we are certainly at a turning point. Never before has the way to our goal been so clear or so near. Never before have we been able to see so clearly or so far.

# 5

## Post Script

At the request of UNICEF-ROSA, Kathmandu, a background note was prepared for the "Third SAARC Ministerial Conference on CHILDREN OF SOUTH ASIA" which was held at Rawalpindi, Pakistan in August 1996. This paper constituted a major portion of that note. The Rawalpindi Resolution on Children of South Asia included the following statement on IDD.

"For accelerating progress towards the goals, WE AGREE TO : Launch a comprehensive nutrition initiative in South Asia supported by measures such as:

i) adoption of the SAARC code on Breast Feeding and young child nutrition;fortification and supplementation of micronutrients like iron, iodine and vitamin A;

ii) adoption of a SAARC convention of iodised salt.

# 6

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# 7

# Biodata

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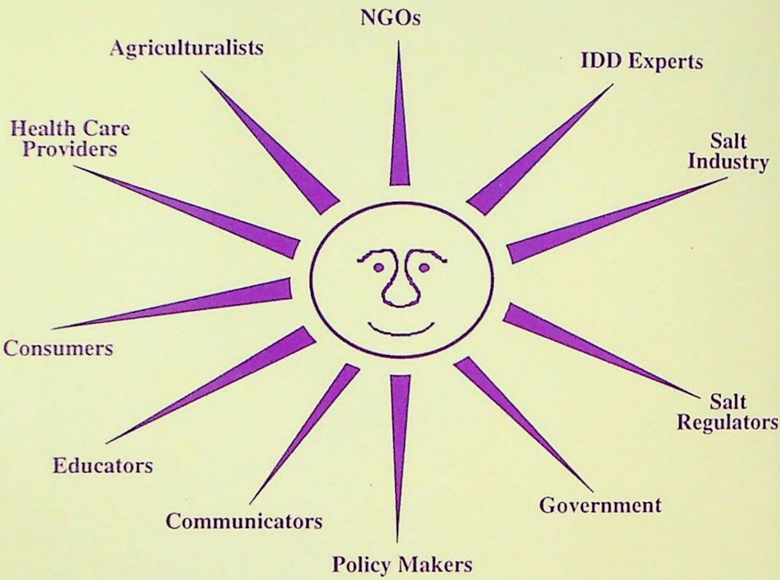
Chandrakant S. Pandav is a medical scientist; epidemiologist & health economist and faculty member at the Centre for Community Medicine, All India Institute of Medical Sciences (AIIMS), New Delhi. Dr Pandav is both a graduate and postgraduate of AIIMS. He has also done M.Sc. (Health Economics, Clinical Epidemiology, Biostatistics) from McMaster University, Canada. Dr. Pandav was a member of a team at AIIMS that showed the serious impact of iodine deficiency on child development. He has published/presented over 150 papers in national and international journals/ conferences. He was Co-editor (With B.S. Hetzel) of the book "S.O.S. for a billion - The conquest of Iodine Deficiency Disorders" published by Oxford University Press, New Delhi, April 1994. He has won many awards for his academic and research activities.

Dr Pandav has worked as a consultant for WHO, UNICEF, PAMM and MI at the global, regional and national level in India, China, Bangladesh, Nepal, Bhutan, Indonesia, Philippines and in the Middle East.

He has played a major role in the policy & advocacy, program development, monitoring & evaluation, operational research and on economic & social benefits of the elimination of iodine deficiency disorders. He is a member of Governing Board, Executive Committee and since 1986 has been the Regional Co-ordinator, South Asia & Pacific of International Council for Control of Iodine Deficiency Disorders (ICCIDD).




**Sustaining Elimination of IDD**

ICCIDD
International Council
for Control of
Iodine Deficiency Disorders

ISBN 81-86813-06-3

# Independent Evaluation of Universal Salt Iodisation (USI)

MADHYA PRADESH

INDIA

Co-ordinated by

ICCIDD

# Independent Survey Evaluation of Universal Salt Iodisation (USI) in Madhya Pradesh

by

International Council for Control of
Iodine Deficiency Disorders
(ICCIDD)

Centre for Community Medicine
All India Institute of Medical Sciences
(AIIMS)

New Delhi - 110 029, India

15 th January, 1996

The International Council for Control of Iodine Deficiency Disorders (ICCIDD) is a non-profit non governmental organization dedicated to the sustainable elimination of Iodine Deficiency Disorders (IDD) throughout the world. The ICCIDD was granted an official status as an International NGO at the 47th World Health Assembly held in Geneva in 1994. It's activities are supported by donations/grants from the Australian Agency for International Development (AusAID), the Canadian International Development Agency (CIDA), the Micronutrient Initiative (MI), the Netherlands Ministry for Development Cooperation, the Swedish International Development Agency (SIDA), the United Nations Children's Fund (UNICEF), the United States Agency for International Development (USAID), the World Bank, the World Health Organization (WHO), and others.

**TO THE GLOBAL PARTNERSHIP DEDICATED TO THE ELIMINATION OF IODINE DEFICIENCY DISORDERS**

*An Ancient Scourge of Mankind*

The People of the affected countries
The Governments of the affected countries

The Salt Producers of each country

The International Agencies-especially
The World Health Organization
The United Nations Children's Fund
The World Bank

The Micronutrient Initiative
Program Against Micronutrient Malnutrition

Kiwanis International

The International Expert Network of
International Council for Control of
Iodine Deficiency Disorders
(ICCIDD)

The Bilateral Agencies especially
The Australian Agency for International Development
The Canadian International Development Agency
The Netherlands Ministry for Development Cooperation
The Swedish International Development Agency
The United States Agency for International Development

We would like to dedicate our efforts
to the memory of James P. Grant who was
Executive Director of UNICEF for 15 years
until his death in January, 1995

and

to the children of Madhya Pradesh.
They have inspired us
to continue working towards the goal of
sustaining the elimination of IDD

James P. Grant
12 May 1922-28 January 1995

# ACKNOWLEDGMENTS

A sincere "thank you"

To all those families who obliged with the survey

To all those who made this study possible and many more.

and

The Rajiv Gandhi Mission
for Elimination of
Iodine Deficiency Disorders
Government of Madhya Pradesh
UNICEF, Bhopal, (Madhya Pradesh)

All India Institute of Medical Sciences, Delhi
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ISBN 81-86813-03-9

Cover design : Gouri Shankar Mukherjee
Photographs : Courtesy of UNICEF

Printed at Sona Printers Pvt. Ltd. B-181 Okhla Ph-1, New Delhi - 20.

## Executive Summary

Iodine deficiency disorders (IDD) continue to threaten the health, well-being, social and economic productivity, and advancement of several hundred million people throughout the developing world. Brain development and intelligence have been shown to be adversely affected. Children living in iodine deficient areas score significantly lower on I.Q. tests by 13 points than those from iodine sufficient areas. Iodisation of salt is the preferred approach for iodine supplementation in iodine deficient populations. Universal Salt Iodisation Programmes are conceptually very simple; however, the successful implementation of an iodisation programme involves the complex behavioral modification of the affected population and changes in salt trade practices. Success of a salt iodisation programme therefore, requires the active support and commitment of all the key stakeholders. Critical elements for sustaining a programme are strong political will, supported by administrative infrastructure and active community participation.

In India, the National Goitre Control Progamme under the Ministry of Health and Family Welfare has helped to provide a policy and advocacy framework from time to time. Some of the key events were the introduction of IDD in Prime Minister Indira Gandhi's "20 Point Progamme" in 1983, adoption of Universal Salt Iodisation (USI) in India by the Central Council of

Health and Family Welfare in 1983, and participation of the private salt traders in the supply of iodised salt.

Iodine Deficiency Disorders were first reported as a public health problem in Madhya Pradesh as early as 1915. Remedial action, however, was initiated only in 1983 after the results of surveys carried out in 1978 and 1983, re-emphasised the gravity of the problem. An iodized salt programme was introduced in four districts of the state in 1983. Subsequently, all the districts of the state were gradually covered by the ban-notification banning the sale of non-iodised salt. The programme was given a major thrust forward in 1988-1990, when during a span of two years, 33 districts were brought under the ban notification, completing coverage of all the 45 districts of the state.

In addition to legislative measures, the need for community participation and a fast-track approach to achieve universal salt iodisation were considered essential for attaining the goal of IDD elimination and sustaining it thereafter.

The "Mission approach" has been adopted by the highest political level, whenever a problem is perceived as requiring urgent action for tangible results. The Mission's approach entails clarity of objectives and strategies to handle a public issue. The plan of action is executed within a defined time-frame by a committed team. Fast-track procedures and collective action by an inter-sectoral effort are the major strengths of this approach. Close monitoring and transparent evaluation are also an integral part of this approach.

The Government of Madhya Pradesh launched seven missions to focus on the three basic needs of the state's rural population: education, health improvement, and employment. The Rajiv Gandhi Mission for Elimination of Iodine Deficiency Disorders is one of the seven missions. It was launched on 20th August 1994. A blend of scientific insight, social commitment, and political will has given this age old scourge a high priority on the human resource development agenda of the governments of Madhya Pradesh.

The objectives of the Mission were to ensure availability of adequately iodised salt, in all villages and towns of Madhya Pradesh, by the end of 1997 and, to increase the awareness of the population on the importance of iodine and the disorders caused by its deficiency. The strategy adopted by the Mission has two clear components: 1) action on the demand side to make communities aware of the need to use adequately iodised salt and, 2) action on the supply side, to ensure distribution and sale of adequately iodised salt.

UNICEF has played a key role in giving technical inputs and in providing support on a regular basis demonstrating an excellent partnership with the Government of Madhya Pradesh.

On completion of the first year of the Mission, the Chief Minister presented a report entitled "Rajiv Gandhi Mission: A Report to the People". The salient achievement of the Mission as mentioned in the report was the consumption of iodised salt was more than 84 per cent of all salt consumed in the state. Therefore, it was proposed to announce the closure of this Mission by 26th January 1996. The Chief Minister also stated that "the closure will be preceded by an independent evaluation to be conducted by a reputed non government evaluation agency."

As a follow up, the International Council for Control of Iodine Deficiency Disorders (ICCIDD), was invited to independently evaluate the status of Universal Salt Iodisation (USI), in Madhya Pradesh.

The primary objective of the evaluation was to determine the proportion of urban and rural households in Madhya Pradesh (MP), consuming adequately iodised salt. The other objectives were to determine the availability of iodised salt in the selected clusters at the retail level in rural and urban areas and, to determine the iodised awareness of the population about iodised salt, IDD, salt use patterns, storage, and cost at the households and retail level.

The field survey was carried out in November 1995 by 20 senior physicians representing 12 premier national institutions and two international organizations. For the purpose of the survey, the state was divided into urban and rural strata. Probability

Proportionate to Size (PPS) Cluster Sampling Methodology was used to select 30 clusters in each of the strata. Field activities included the collection of salt samples from households and retail shops. In addition, the Knowledge, Attitude, Practice and Behaviour (KAPB), of household members and retail shopkeepers was assessed through survey interviews.

Salt samples were analysed for iodine content by iodometric titration - the internationally accepted gold standard - at the All India Institute of Medical Sciences (AIIMS), New Delhi, under the technical supervision of a senior advisor to the ICCIDD. All data collected were analysed by a specially designed computer software package.

The results show that the state of Madhya Pradesh has achieved universal availability of iodised salt as 98.4 per cent of the salt samples were found to be iodised at the household level (urban = 98.9 per cent; rural = 98.3 per cent). With respect to adequate iodine content, 69 per cent of urban households and 61 per cent of rural households were found to be consuming adequately iodised salt. This truly represents a remarkable achievement for a state that imports all of its salt requirement.

The possible reasons for the inadequate level of iodine in salt found in over 31 per cent of urban and 39 per cent of rural households are: inadequate iodisation at the production level, problems with packaging, storage and transportation before it reaches it's destination and, quality assurance issues at the repacking units within the state.

In order to address these issues effectively, there is a need for organizing continuous dialogue with manufacturers, the salt commissioner's office, railways and road transport agencies. Stringent enforcement of P.F.A. rules is also necessary.

The positive awareness about iodised salt among urban and rural households was 65 per cent and 44 per cent, respectively. Television programmes and health workers were the major sources of information to those who had heard about iodised salt.

Other salient points revealed in the survey include:

- most of the urban households (88 per cent) were consuming powdered salt

- 32.1 per cent of rural households were using crystalline salt

- about 30 per cent of powdered salt samples at both urban and rural households levels were inadequately iodised

- as many as 38 per cent of the crystalline salt samples used in rural households were adequately iodised, contrary to popular opinion that all powdered salt is iodised and all crystalline salt is non-iodised

• the practice of salt purchase and storage was found to be almost identical in both urban and rural households

• retail shops catering to the households included in the samples seem to sell only iodised salt both in urban (99 per cent) and rural (97.9 per cent) areas

• it seems that 73 per cent of urban retail shop samples and 66 per cent of rural retail shop samples are adequately iodised. This was consistent with observations made at the households level

The major achievement of the Mission was in streamlining and strengthening the IDD elimination measures that were already in place. The specific achievements of the Mission as perceived by the evaluation team were:

i) involvement of the salt traders in implementing the Universal Salt Iodisation programme. "The Bhopal Declaration" by the salt traders was an important landmark in this respect.

ii) forgoing partnerships between the programme managers and the key stakeholders to understand each other's viewpoints and constraints

iii) Nagarik Apoorti Nigam (NAN) was involved as a catalyst to ensure the availability of adequately iodised salt, particularly in the remote tribal and hilly areas. The NAN uses a social pricing strategy to maintain the price of the packaged iodised salt.

iv) the district administration, the health department, and the education department were involved on a larger scale in creating awareness, and monitoring of, the iodine content of salt.

In **conclusion**, the Mission approach has succeeded in giving a thrust to the ongoing IDD elimination programme. The achievements thus far obtained have to be sustained. This is the most critical period as complacency at this stage will lead to a "sliding down effect". This transistional phase, from a "Mission approach" to a "System approach", is crucial, especially at a time when the whole IDD programme has just taken off and has not yet gathered the critical momentum needed to progress on it's own.

To consolidate the achievements of the Mission and sustain the elimination of IDD in Madhya Pradesh, the following **recommendations** are proposed:

1. The IDD elimination programme should continue to get the same level of priority and urgency in implementation from political, administrative, and social sectors.

2. The intersectoral co-ordination so far achieved during the mission should be retained and preferably enhanced at all levels.

3. The approach of ensuring community participation in the programme has to be sustained and made more broad-based. The involvement of the educational

system, Panchayat system and consumer organisations should be further strengthened for creating awareness and participation in monitoring.

4. The Mission Director's role has to be taken over by a responsible officer from any of the participating departments, which would consequently be identified as a nodal agency to implement the programme.

5. The monitoring system should include social monitoring, regulatory monitoring and health monitoring. Social monitoring should be done by schools, communities, consumer organisations, Panchayats and opinion leaders on the availability of iodised salt, by testing it with a spot testing kit and by recording its price.

6. With respect to regulatory monitoring, the Directorate of Food and Drug Control, with the help of active support of health agencies, should enforce the P.F.A. Act.

7. In addition to monitoring the process indicators of the IDD elimination progamme, health monitoring should include the impact indicators, namely goitre prevalence and urinary iodine in schoolage children and should be measured every five years.

The success story of Madhya Pradesh in operationalising the scientifically sound and cost-effective programme of USI in eliminating IDD should be widely communicated to the people of Madhya

Pradesh and the nation at large. This role model will prove to be the guiding principle for implementing many other health related social development issues.

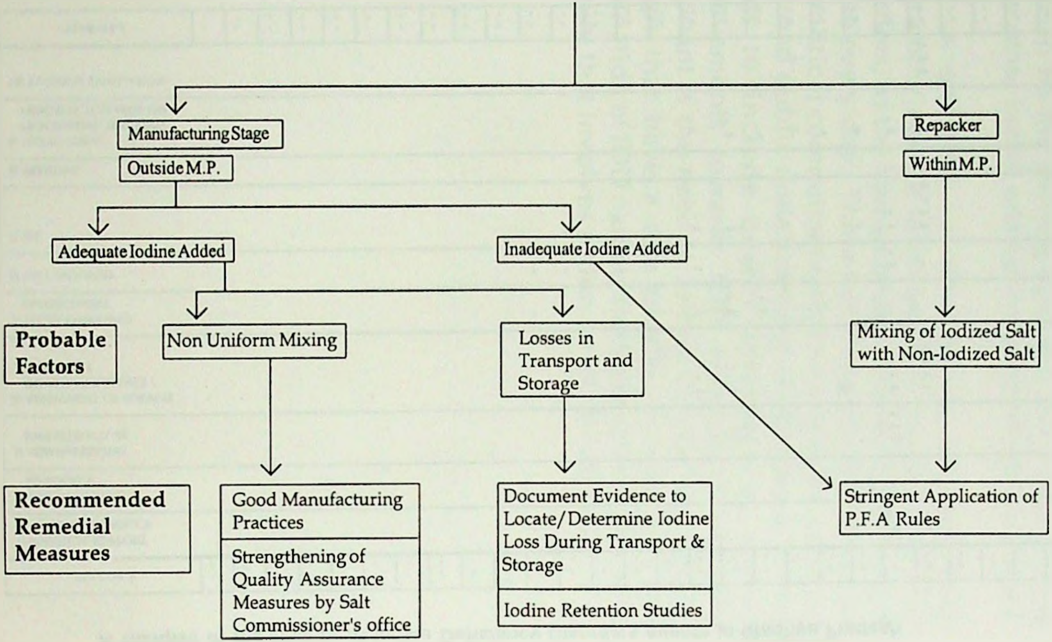
A one time, or time bound salt iodization programme cannot eliminate the spectrum of IDD disorders, as the human body requires 100-150 $\mu$g of iodine every day. There fore it is essential to sustain the political commitment which can be strengthened by broad public understanding of the issues. Policy needs to include quality assurance to sustain achievements towards IDD elimination. Equally important is the need to further involve the various groups that have a role to play in sustaining the elimination of IDD namely the stakeholders, for it is a venture that involves action by all, for all times.

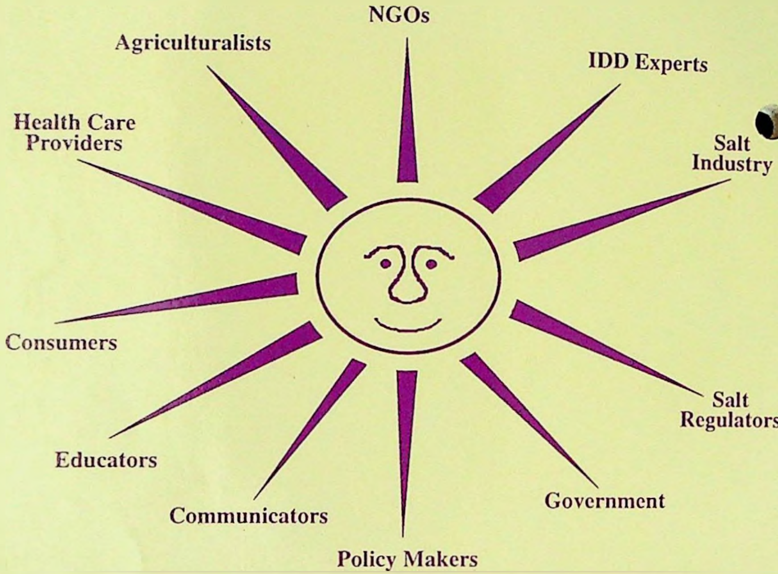
# A Glimpse at the History of Iodine Deficiency Disorders events in Madhya Pradesh

| YEAR (19..) | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1) POLITICAL SUPPORT PROGRAMME POLICY | | | | | | | | | | | | | | | | | | | | | | •• | ••• | | | | |
| 2) INTERNATIONAL ADVOCACY | | | | | | | | | | | | | | | | | | | | | | • | | | | | |
| 3) ADMINISTRATIVE INFRASTRUCTURE | | | | | | • | | | | | | | | | | | | | | | • | •••••• | | | | | |
| 4) ASSESSMENT OF SURVEYS ON IDD PREVALENCE / KAPB / SALT | • | • | | | | • | | | | | | •• | | | | ••• | •• | | | | | ••••• | ••••••••• | | | | |
| 5) LEGISLATION AND ENFORCEMENT | | | | | | | | | | | • | | | | • | •• | ••• | ••• | | | | | | | | | |
| 6) SALT INDUSTRY | | | | | | | | | | | • | • | | | | •• | | | | | | ••• | • | | | | |
| 7) IEC | | | | | | | | | | | | • | | | | ••• | •• | | | | • | ••• | •••••••• | | | | |
| 8) TRAINING | | | | | | | | | | | | | | | | | | | | | | | • | | | | |
| 9) MONITORING PROGRAMME: TRACKING PROGRESS TOWARDS USI | | | | | | | | | | | | | | | | | ••• | • | • | • | • | ••• | ••• | | | | |
| 10) EXTERNAL EVALUATION | | | | | | | | | | | | | | | | | | | | | | | •••••• | | | | |
| YEAR (19..) | 73 | 74 | 75 | 76 | 77 | 78 | 79 | 80 | 81 | 82 | 83 | 84 | 85 | 86 | 87 | 88 | 89 | 90 | 91 | 92 | 93 | 94 | 95 | 96 | 97 | 98 | 99 |

This timeline illustrates event (by a" •") that have taken place in the history of IDD programme in Madhya Pradesh

## Inadequately Iodised Salt at Household & Retail Level in M.P. : Probable Factors and Recommended Remedial Measures






# Sustaining Elimination of IDD

ICCIDD

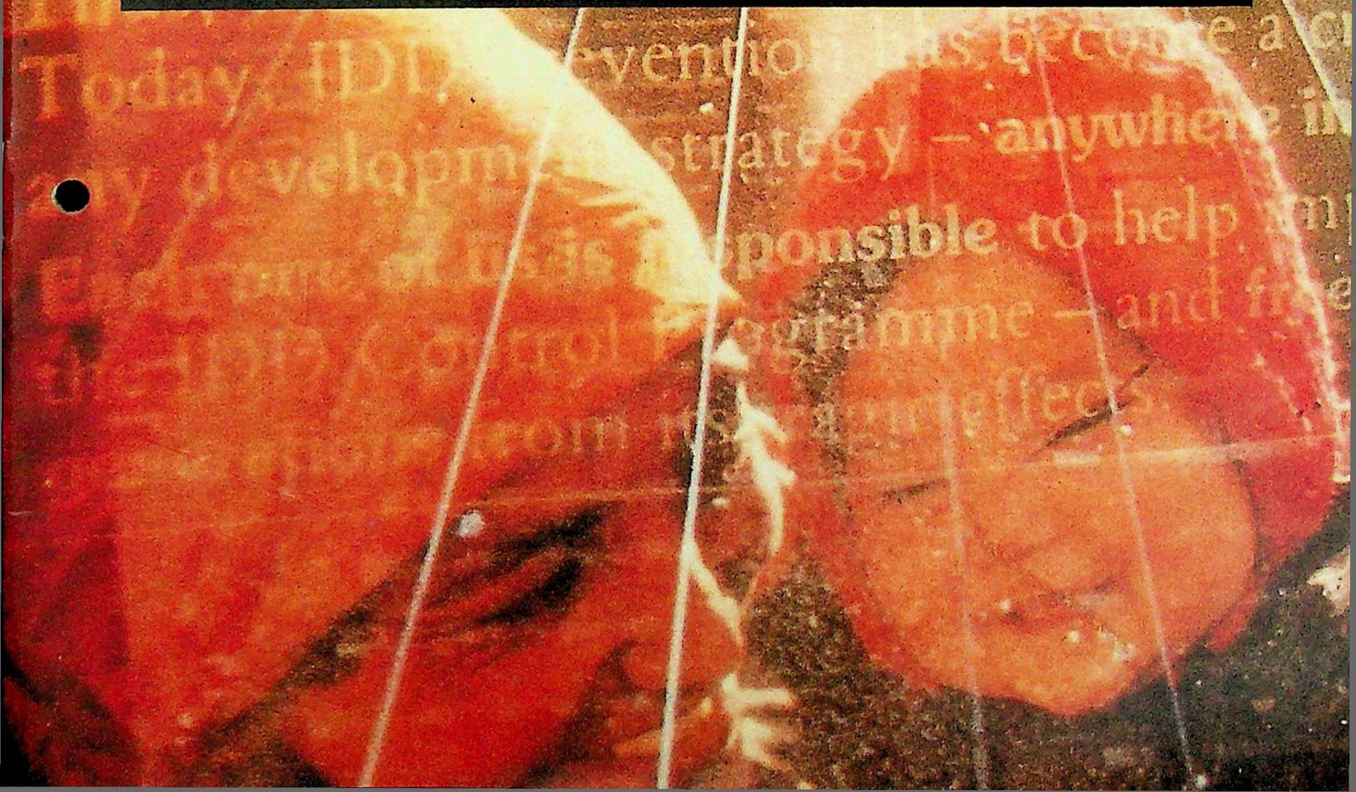
International Council
for Control of
Iodine Deficiency Disorders

ISBN 81-86813-03-9

Introduction to

# INTERNATIONAL COUNCIL FOR CONTROL OF IODINE DEFICIENCY DISORDERS

(ICCIDD)



The International Council for Control of Iodine Deficiency Disorders (ICCIDD) is a non-profit non-governmental organisation dedicated to the sustainable elimination of iodine deficiency disorders (IDD) throughout the world. The ICCIDD was granted an official status as an International NGO at the 47th World Health Assembly held in Geneva in 1994. It's activities are supported by donations/ grants from the Australian Agency for International Development (AusAID), the Canadian International Development Agency (CIDA), the Micronutrient Initiative (MI), the Netherlands Ministry for Development Cooperation, the Swedish International Development Agency (SIDA), the United Nations Children's Fund (UNICEF), the United States Agency for International Development (USAID), the World Bank, the World Health Organisation (WHO), and others.

TO THE GLOBAL PARTNERSHIP
DEDICATED TO THE ELIMINATION OF
IODINE DEFICIENCY DISORDERS

*An Ancient Scourge of Mankind*

The People of the affected countries
The Governments of the affected countries

The Salt Producers of each country

The International Agencies-especially
The World Health Organization
The United Nations Children's Fund
The World Bank

The Micronutrient Initiative
Program Against Micronutrient Malnutrition

Kiwanis International

The International Expert Network of
International Council for Control of
Iodine Deficiency Disorders
(ICCIDD)

The Bilateral Agencies especially
The Australian Agency for International Development
The Canadian International Development Agency
The Netherlands Ministry for Development Cooperation
The Swedish International Development Agency
The United States Agency for International Development

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**ISBN 81-86813-04-7**

Cover design by: Salim Meme

Printed at Sona Printers Pvt. Ltd. B-181 Okhla Ph-1, New Delhi - 20.

# Contents

# Preface

Iodine deficiency is the most common preventable cause of brain damage in the world today.

This book introduces the Consulting Services of the International Council for the Control of Iodine Deficiency Disorders (ICCIDD). It provides a brief account of the history and function of the ICCIDD and its relation to the international agencies and to national governments.

The ICCIDD now has a multidisciplinary network of 400 experts drawn from 82 different countries, who are committed to the development and monitoring of national programs for the sustainable elimination of IDD.

In 1990 the goal of elimination of IDD as a public health problem by the year 2000 was adopted by the 43rd World Health Assembly for the World Health Organization. The Executive Board of UNICEF passed a similar Resolution.

The World Summit for Children, attended by 71 Heads of State and 88 representatives of other governments meeting at the United Nations, New York, September 1990 approved a Plan of Action which included the virtual elimination of Iodine deficiency disorders by the year 2000.

This book is designed to help achieve the goal of elimination by indicating the available expertise of the members of the ICCIDD to all agencies and governments. The ICCIDD provides technical assistance to governments and agencies on all aspects of development and monitoring of national programs.

The ICCIDD welcomes contact by Agencies and Governments. Procedures for Consultations are described.

The ICCIDD recognises that in order to sustain elimination of IDD a complex network of activities of quality assurance of modern management in the national efforts is required. This will take a good bit of effort by all concerned - the "stakeholders", - since it involves management issues in nutrition, in health, in education, in agriculture, in salt manufacture, in raw material provision, in human resource development, in public education, and in sustained consumer demand.

The ICCIDD mandate is to promote collaboration with stakeholders in the spirit of true partnership to end the hidden hunger of iodine deficiency.

The ICCIDD assures all concerned of its commitment to work with them in the achievement of the great goal of elimination of the ancient scourge of iodine deficiency.

Basil S. Hetzel, MD
Chairman
ICCIDD

January, 1996

F. Delange, MD
Executive Director
ICCIDD

# Introduction

Iodine Deficiency Disorders, or IDD, refers to a variety of health problems caused by insufficient iodine in the diet. Iodine is an essential nutrient for thyroid function and through this for normal human growth and development, particularly of the brain and intellectual capacities. An estimated 1.6 billion people on earth in 110 countries live in areas where the soil is iodine deficient and iodine-rich seafood is unavailable or not a part of the local diet. This leads to devastating consequences causing thyroid function abnormalities and where the deficiency is severe, endemic goitre and cretinism, mental retardation, reduced fertility and increased perinatal and infant mortality.

***Advocacy by the ICCIDD through UNICEF & WHO led the 1990 United Nations World Summit for Children to commit itself to the goal of virtual elimination of Iodine Deficiency Disorders by the year 2000.***

Iodine deficiency was once considered a minor problem, causing goitre, an unsightly but seemingly benign cosmetic blemish. However, it is now known that iodine deficiency is the most common preventable cause of mental handicap in the world today, constituting a threat to the social and economic development of many countries of the world including European countries.

The industrialized world has made great strides in combating iodine deficiency inspite of the persistence of severely affected areas, particularly in the eastern parts of Europe. A number of countries in Latin America have achieved notable success, and in Asia, IDD elimination is progressing in countries where national programs have been launched. Finally, Africa has shown very significant progress except in countries where major political instability impaired the implementation of health programs.

The solution is relatively simple. A teaspoon of iodine is all a person requires in a lifetime, but because iodine cannot be stored for long-periods by the body, tiny amounts are needed regularly. In areas of endemic iodine deficiency, where soil and therefore crops and grazing animals do not provide sufficient dietary iodine to the populace, food fortification and supplementation have proven highly successful and sustainable interventions. Iodized salt programs and iodized oil supplements are the most common tools in the fight against IDD.

# ICCIDD

The International Council for Control of Iodine Deficiency Disorders (ICCIDD) is the only international organization specifically constituted to promote the elimination of IDD. ICCIDD's multidisciplinary global network of experts consists of some 400 specialists from more than 82 countries. They include scientists in the medical and nutrition fields, public health administrators, development managers, technologists, communicators, economists, salt technologists and other industry experts. All of them are committed to assisting governments and international agencies in developing national programs for the virtual elimination of IDD as a public health problem.

ICCIDD was formed in 1986 with support from UNICEF, WHO and the Australian government in order to bridge the gap between available knowledge and its application in solving the problem of IDD for the millions at risk. ICCIDD has played a major role in communicating the IDD threat to decision makers of national governments and international agencies and to a wide variety of health professionals and planners.

***The UN mid-decade goal of Universal Salt Iodization by 1995 is a critical step in the virtual elimination of IDD. ICCIDD multidisciplinary experts can help make that goal attainable and to sustain it thereafter.***

By participating in public policy development and advocacy, program development, implementation and training, ICCIDD consultants assist countries with significant IDD problems to develop national IDD control programs, in cooperation with:

- national governments
- institutions and individuals
- private industries and welfare agencies
- major international agencies
- key bilateral aid giving agencies

ICCIDD is a non-profit, non governmental organization (NGO) with official consultant status with WHO and the UN system and an official participant in the annual World Health Assembly.

# ICCIDD Mandate

*The goal of ICCIDD is to support national efforts to virtually eliminate IDD from the globe by the year 2000.*

*To achieve 'Goal 2000', ICCIDD works where IDD is a problem, consulting with governments and development agencies at the national level to ensure that national plans are in place to achieve the goal and to sustain virtual elimination once it is achieved.*

- to promote awareness of the magnitude of IDD and the fact that it can be eliminated at an affordable cost;
- to provide technical assistance in the assessment of prevalence in countries and the development of strategies for IDD elimination;
- to provide technical assistance in monitoring the application of these strategies and evaluate their effectiveness;
- to support training programs at national and regional levels for survey design, program management, monitoring and evaluation, social communication and technical assistance to quality assurance systems;
- to encourage research on issues relating to the virtual elimination of IDD.

**Photograph of Mother (with a goitre) holding a child**

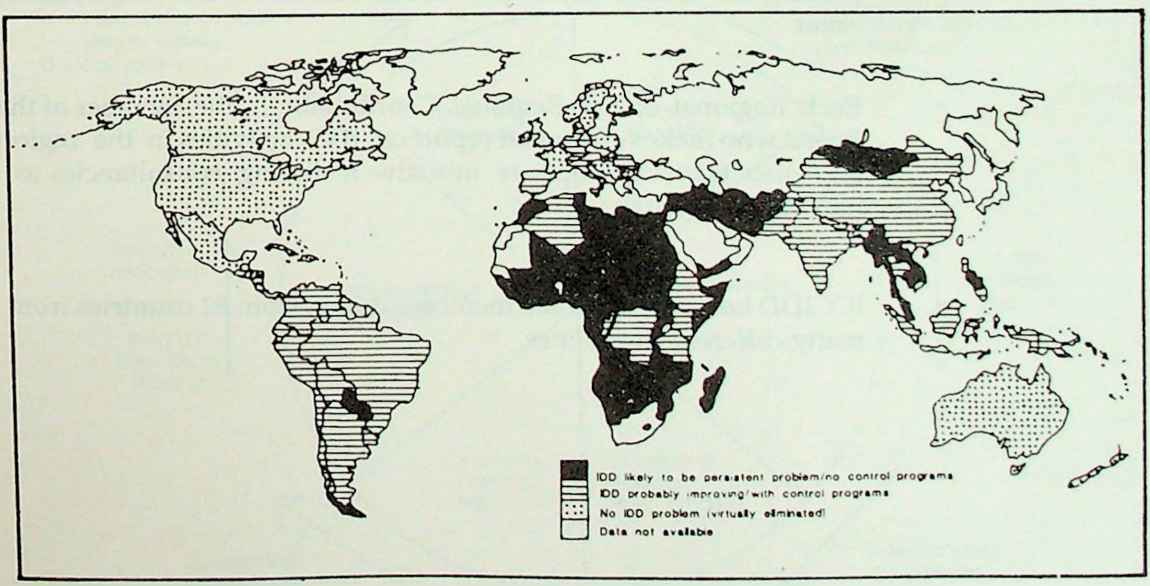
**Global Milestones in IDD awareness**

| | |
|---|---|
| 1960 | The World Health Organization (WHO) presents the first comprehensive review of goitre on a world scale, underlining the severity of the problem. However, in spite of the successful elimination of IDD in a number of industrialized countries, only very slow progress is made in developing countries during the next 15 years. |
| 1974 | The World Food Council is the first of a number of international organizations over the next decade to call for the elimination of goitre. |
| 1983 | The concept of iodine deficiency disorders (IDD) is introduced with emphasis on the effects of iodine deficiency on brain function. |
| 1985 | With support from UNICEF, WHO & Australian government, the ICCIDD is founded in order to bridge the gap between available knowledge and its application. |
| 1987 | The United Nations Sub-Committee on Nutrition establishes an IDD Working Group to receive an Annual Report on Progress. |
| 1990 | The 43rd World Health Assembly in Geneva recognizes IDD elimination as a major priority. |
| | The UN World Summit for Children, attended by 71 Heads of State and representatives of 159 governments, adopts a plan of action that includes the virtual elimination of IDD by the year 2000. |
| 1991 | Ending Hidden Hunger (A policy conference on Micronutrient Malnutrition) Montreal, Canada. |
| 1992 | The 45th World Health Assembly and the WHO-FAO Interna tional Conference on Nutrition. Commitment confirmed. |

# ICCIDD Activities

- Consulting services
- Collaboration
- Program Implementation
- Research
- Training
- Monitoring
- Communication
- Publications

The Logo of ICCIDD. This shows the human brain within the skull which emphasizes the importance of the brain in the effects of iodine deficiency




The map shows the active progress of national IDD Elimination programmes throughout the world. Countries are grouped into four categories. (From WHO (1990) with permission)

# ICCIDD Structure

- The ICCIDD has a Governing Board of 38 members with more than half from developing countries and the international agencies. The Board meets annually, usually in conjunction with a regional meeting or a special workshop.

- ICCIDD has the executive of seven members which includes Chairman, Vice-Chairman, Executive Director, Secretary & three members.

- Executive Director's position is full-time, the others being part time. The Executive Director is responsible for the global secretariat in Brussels, Belgium with a small & committed office staff.

- The ICCIDD has Regional Coordinators for Latin America, South Asia and Pacific, China and Eastern Asia, Europe, Eastern Europe and Central Asia.

- In Africa three Sub Regional Coordinators are responsible for countries in the North and West (both anglophone and francophone), for Central (francophone) and East and South (anglophone) areas.

- Each Regional or Sub Regional Coordinator is the member of the Board who makes an annual report on IDD activities in the region and also takes appropriate initiative including consultancies to individual countries.

- ICCIDD has more than 400 members drawn from 82 countries from many different disciplines.

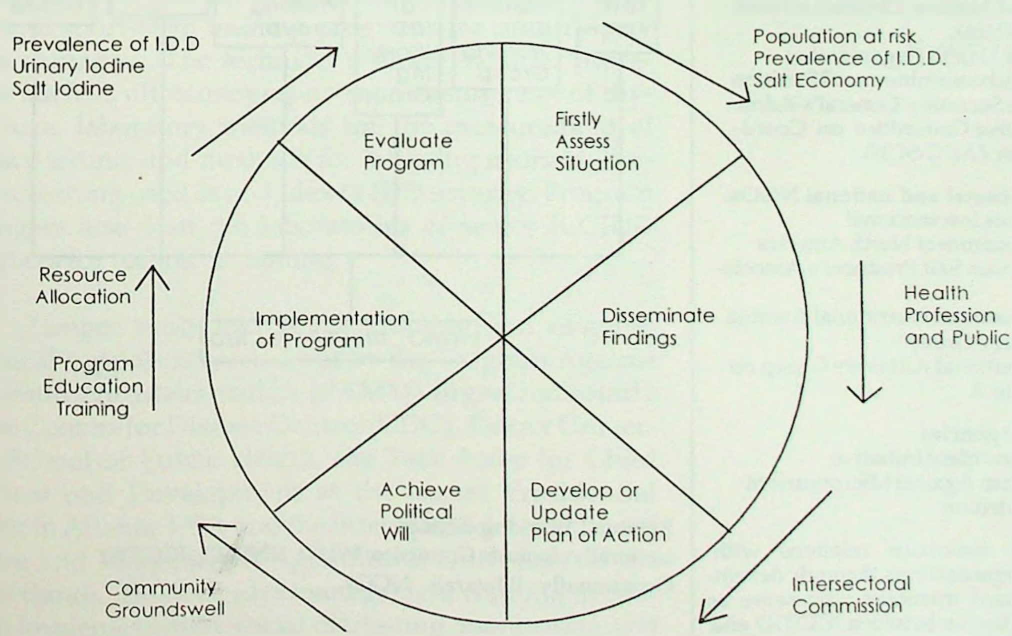
# ICCIDD Multidisciplinary Team of Experts

ICCIDD recruits consultants from over 82 countries to provide culturally and politically sensitive experts with the highest scientific, technical and managerial capabilities. These consultants work in every aspect of IDD elimination programme to help keep the wheel turning (see figure),

- Epidemiological, experimental & clinical studies; endocrinology, obstetrics, paediatrics, public health, radiology, clinical biochemistry, radioimmunology, nuclear medicine, pharmacology and animal nutrition;
- Assessment & program design;
- Iodization of salt & other technologies;
- Planning & training;
- Management & program development;
- Technical assistance to quality assurance systems;
- Monitoring & evaluation;
- Communication & education;
- Advocacy & social marketing.

***ICCIDD's multidisciplinary teams of experts provide comprehensive and cost effective technical, scientific and managerial assistance.***

PROCESS MODEL FOR NATIONAL IDD ELIMINATION PROGRAM



# Collaboration

ICCIDD's principal strategic allies for the sustained elimination of IDD are:

**Governments of affected countries**

**The People of affected countries**

**Private Industry including:**
- Salt Industry
- Food Industry
- Pharmaceutical Industry

**National Governments and their bilateral development agencies, including:**
- Government of Australia and AusAID
- Government of Belgium
- Government of Canada and CIDA
- Government of the Federal Republic of Germany
- Government of Japan
- Government of The Netherlands
- Government of Sweden
- Government of the United States of America and USAID

**United Nations**
- United Nations Children's Fund
- World Bank
- World Health Organization
- The Subcommittee on Nutrition of the Secretary General's Administrative Committee on Coordination. (ACC-SCN)

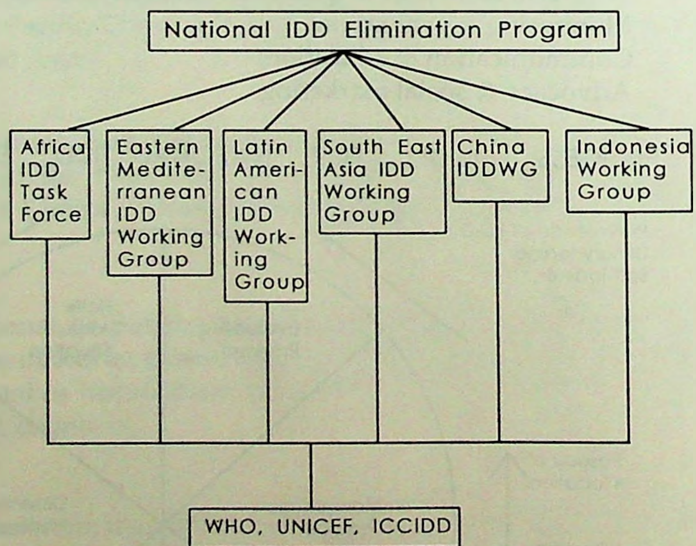
**International and national NGOs:**
- Kiwanis International
- Salt Institute of North America
- European Salt Producer's Association
- International Nutritional Anemia Advisory Group
- International Advisory Group on Vitamin A

**Other Agencies**
- Micronutrient Initiative
- Program Against Micronutrient Malnutrition

ICCIDD maintains relations with these organizations through designated board members who serve as official liaison between ICCIDD and each of the agencies and organizations listed above.

Since 1986, ICCIDD regional coordinators have collaborated with UNICEF and WHO regional representatives and representatives from bilateral agencies and NGOs in regional IDD working groups and task forces to initiate and monitor elimination programs. There is now a Task Force in place for Africa and IDD Working Groups for Eastern Europe, Latin America, South East Asia, China and Indonesia.

ICCIDD serves as the expert consultative body on IDD issues in the support of elements of United Nations system, and ICCIDD consultants are available to all interested parties. Please refer to page 14 for client procedures to request and obtain consulting services.




Regional Working Groups
Generally: Include Countries, WHO, UNICEF, ICCIDD
Occasionally: Bilaterals, NGOs

# Research and Training

## Research

Because of its unique network of experts and close connection with the academic world, ICCIDD is able to initiate, stimulate, realize and support research activities in all disciplines involved in the field of IDD. The results of research are widely and rapidly disseminated and applied directly through programs or incorporated in technical guidelines.

*The elimination of IDD has been made possible by the significant contributions of ICCIDD members dating from the pioneering research of John B. Stanbury (Chairman Emeritus of ICCIDD) and his colleagues who, first clearly demonstrated in the Andean Region of South America the mechanisms by which iodine deficiency caused goitre.*

For example, ICCIDD has determined optimal dosage levels for iodized oil when given orally or by intramuscular injection, including during pregnancy. Other applied research includes simplifying methods for measuring iodine in urine and standardization of thyroid volume as a function of age in the absence of iodine deficiency.

## Training

ICCIDD, in close collaboration with UN and bilateral agencies, organizes national and international meetings and short-term training programs for country program managers. The technical training includes procedures such as ultrasonography for measurement of thyroid size, laboratory methods for the measurement of urinary iodine, and methods for initiating neonatal thyroid screening used as an index of IDD severity. Program managers also visit the laboratories of senior ICCIDD members for technical training.

Longer multidisciplinary training and ongoing technical support is carried out by the Program Against Micronutrient Malnutrition (PAMM) organized jointly by the Centers for Disease Control (CDC), Emory University, School of Public Health, the Task Force for Child Survival and Development at the Carter Presidential Center in Atlanta, USA and the International Agricultural Centre and Wageningen Agricultural University in the Netherlands. This includes management training in program implementation, social marketing, monitoring and quality assurance, food fortification and laboratory measurements and legal aspects of fortification. Senior members of ICCIDD participate in PAMM teaching activities.

Social Mobilization (SOCMOB) training is conducted by Tulane University School of Public Health in New Orleans, USA and through a network of institutions in Benin, Bolivia, Brazil, Ecuador, Ethiopia and the Philippines.

# Monitoring

ICCIDD is able to assist national governments and agencies with an independent evaluation of progress towards the goal of virtual elimination of IDD at country level. Experience indicates that this is important in order to ensure sustainability of the elimination of IDD. Following a request, ICCIDD will assist national governments to review progress, exchange mutually supportive information and results, and sustain elimination once it is achieved. in order to sustain elimination of IDD a complex network of activities of quality assurance of modern management in the national efforts is required. This will take a good bit of effort by all concerned - the "stakeholders", - since it involves management issues in nutrition, in health, in education, in agriculture, in salt manufacture, in raw material provision, in human resource development, in public education, and in sustained consumer demand.

**Funding**

ICCIDD was initially supported by UNICEF, WHO and the Australian Government. Other major donors for core funds include:

- the Australian Agency for International Development (AusAID)
- the Canadian International Development Agency (CIDA)
- the Dutch Cooperation Programme
- the International Bank for Reconstruction and Development (IBRD)
- the Swedish International Development Agency (SIDA)
- the United States Agency for International Development (USAID)

In addition, individual project grants have come from USAID, the Micronutrient Initiative, Thrasher Fund, private industry and others for newsletters, databases and research. Kiwanis International is raising funds for UNICEF programs to substantially support country programs aimed at the virtual elimination of Iodine Deficiency Dis orders.

***Iodine Deficiency Disorders are endemic and the brain damage is irreversible. However, virtual elimination can be attained through iodized salt and ongoing monitoring, iodized salt promotion and program evaluation.***

# Communication & Publications

ICCIDD organizes and sponsors meetings, conferences and other gatherings designed to enhance knowledge about IDD, to accelerate national action towards its elimination, and to create effective alliances with other organizations for these purposes.

ICCIDD has established a communication focal point at the International Communication Enhancement Center (ICEC) of Tulane University School of Public Health to coordinate ICCIDD communication activities and to promote special events and competitions that increase public and institutional awareness of IDD. It is also an information depository for IDD related materials, such as reports, studies, photos, tapes, films, videos, articles, training materials and posters for public education and information purposes and a point of referral for inquiries.

**IDD Newsletter**

ICCIDD publishes a quarterly newsletter edited by Dr. John Dunn at the University of Virginia Medical Center. It provides timely information and updates on Iodine Deficiency Disorders and related subjects. First published in 1985 and distributed to individuals and institutions, the newsletter now has a circulation of nearly 3,500 with approximately 80% copies going to developing countries. The newsletter plays a key role in connecting all individuals and organizations around the world interested in the topic of IDD. It is available free of charge from the editor.

### Technical Manuals

ICCIDD currently has the following technical manuals available:

- A practical guide to the correction of iodine deficiency, by J.T. Dunn and F. Van der Haar, ICCIDD Publ., 1990.
- Methods for measuring iodine in urine, by J.T. Dunn, H.E. Crutchfied, R. Gutekunst and A.D. Dunn, ICCIDD Publ., 1993.
- 'Indicators for Assessing Iodine Deficiency Disorders and their Control through Salt Iodization'. Report of a Joint WHO/UNICEF/ICCIDD Consultation, 3 - 5 November,1992, WHO, Geneva. Document WHO/NUT/94.6, Publ. 1994.

**Technical Manuals (cont'd)**

- Monitoring Universal Salt Iodization Programs edited by Kevin M. Sullivan, Robin Houston, Jonathan Gorstein, Jenny Cervinskas .

  ICCIDD/ MI/ PAMM/UNICEF / WHO., Publ.,1995

- Salt Iodization for the Elimination of Iodine Deficiency by M. G. Venkatesh Mannar & John T. Dunn,

  ICCIDD/MI/UNICEF/WHO Publ.,1995.

Other manuals are in preparation on:

- laboratory testing for iodine deficiency
- iodized oil and other alternatives to iodized salt.
- communication techniques

An appendix listing other IDD related publications that are available from ICCIDD can be found on page 18.

# ICCIDD Consulting Services

How to request ICCIDD consulting services.

1. ICCIDD has prepared a roster of consultants indicating their areas of expertise and previous consulting experience.

2. Prospective requests by governments, institutions or individuals can be sent directly to the ICCIDD or through a United Nations or Bilateral Agency.

If the requests are to be made directly to the ICCIDD, they can be forwarded directly to the Executive Director or to any of the ICCIDD Office bearers given on pages 15 to 17.

If the request to ICCIDD is through a United Nations Agency or a Bilateral Development Agency, a discussion with the Representative of that Agency resident in the country may reveal additional requirements and procedures.

3. In any of the possibilities mentioned in point. no. 2 the request must contain the following:

- The official request for technical assistance.
- The Terms of Reference for the assistance required.
- The proposed duration of the work to be accomplished and the proposed dates most suitable, with an alternative possibility.
- The source of payment. It is preferable that formal statements of commitment accompany the request.
- The proposed budget for the consultant (s) including travel costs, services, perdiem and miscellaneous, and other estimated costs.
- The purpose of the assignment. The Terms of Reference will support this statement. The end product expected must be stated, also (i.e. final report; a document for planning purpose; an analysis including laboratory work, etc.)
- Special qualifications or specialized knowledge or skills deemed required.
- Language in which the work will be undertaken; language in which product is expected.
- Name and title of supervisor or principal authority or individual to whom the consultant reports in the Government of the concerned country.

**NOTE: A special booklet is available from ICCIDD offices which provide further details on the technical and advisory services available through ICCIDD.**

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(as of January, 1996)

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# Appendix

The following is a partial list of publications produced by ICCIDD members, independently or in collaboration with national or international bodies and publishing houses:


1. Stanbury, J.B., G.L. Brownell., D.S. Riggs., H. Perinetti., J. Itoiz and E.B. Del Castillo. Endemic goiter. The adaptation of man to iodine deficiency. Harvard University Press, Cambridge, MA 1954.

2. Stanbury, J.B. and B.S. Hetzel editors, Endemic goiter and endemic cretinism: iodine nutrition in health and disease. Wiley Publications, New York 1980.

3. Dunn, J.T., E.A. Pretell, C.H. Daza and F.E. Viteri. editors, Towards the eradication of goiter, cretinism and iodine deficiency. PAHO Publ., Washington 1986.

4. Kochupillai, N., M.G. Karmakar and V. Ramalingaswami editors, Iodine nutrition, thyroxine and brain development. Tata McGraw Hill Publ., Delhi 1986.

5. Medeiros-Neto, G., R.M.B. Maciel and A. Halpern editors, Iodine deficiency disorders and congenital hypothyroidism. Sao Paolo 1986.

6. Hetzel, B.S., J.T. Dunn and J.B. Stanbury editors, The prevention and control of iodine deficiency disorders. Elsevier Publ., Amsterdam, 1987.

7. Delong, R., J. Robbins and P. Condliffe editors, Iodine and the brain. Plenum Press Publ., New York 1989.

8. Hetzel, B.S., The story of iodine deficiency. An international challenge in nutrition. Oxford University Press Publ., Oxford 1989.
   (Also available in French, Spanish.,Chinese, Japanese and Russian.)

9. Delange, F., D.A. Fisher., and D. Glinoer editors, Research in congenital hypothyroidism. Plenum Press Publ., New York 1989.

10. Delange, F., J.T. Dunn., and D. Glinoer editors, Iodine deficiency in Europe. A continuing concern. Plenum Press Publ., New York 1989.

11. Hetzel, B.S., C.S. Pandav editors, SOS for a billion: the conquest of Iodine Deficiency Disorders. Oxford University Press Publ., Delhi 1994.

12. Stanbury, J.B editor, The damaged brain of iodine deficiency. Cognizant Communications 1994.

13. Maberly, G.F., F.L. Trowbridge., R. Yip., K.M. Sullivan., C.E. West. Programs Against Micronutrient Malnutrition. Annu. Rev. Public Health. 50:259, 1994.

14. Rose Nathan, Food Fortification Legislation & Regulations Manual, PAMM 1995.

15. Karmarkar, M.G., C.S. Pandav and M.M.S. Ahuja editors, Enviornment, Genetics and Thyroid Disorders. Thyroid Association (India) Publ., 1990.

**How to become a member of ICCIDD**

1. Contact any ICCIDD regional co-ordinator or any ICCIDD office bearers listed on pages 15 to 17.

2. Indicate your interest in IDD and submit brief details of your qualifications and experience.

3. Communication will be then sent from the ICCIDD office accepting the membership

4. No fees are required.

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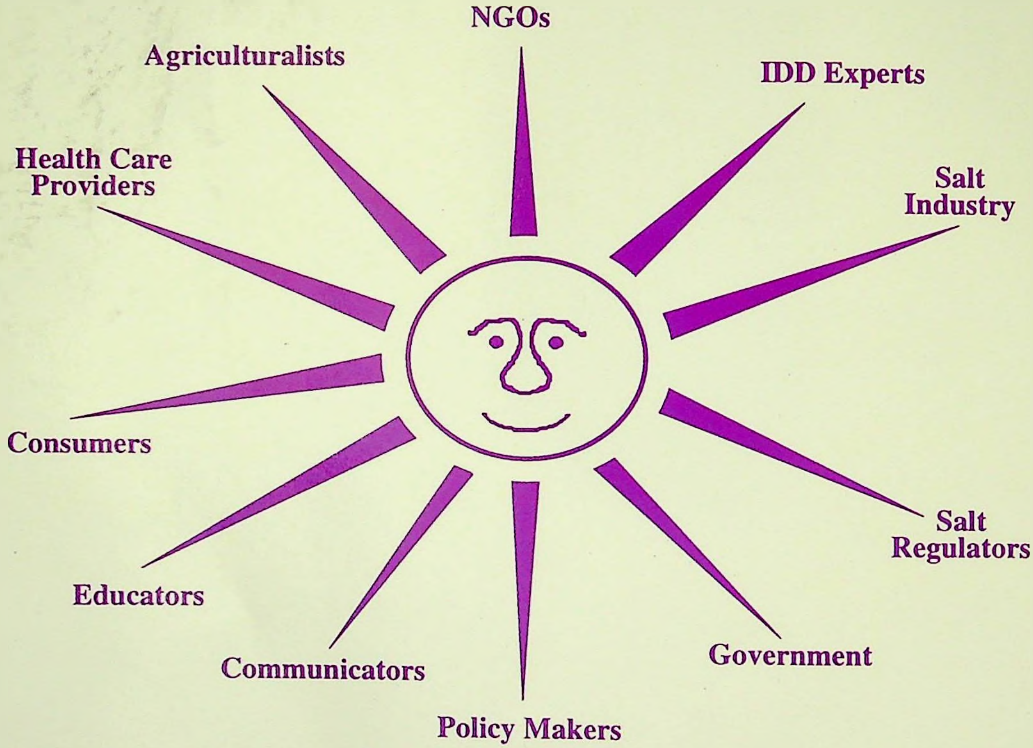



## Sustaining Elimination of IDD

**ICCIDD**

International Council for Control of Iodine Deficiency Disorders

ISBN 81-86813-04-7

# International and National Media Coverage of

ICCIDD INTERNATIONAL COUNCIL FOR CONTROL OF IODINE DEFICIENCY DISORDERS

# IDD NEWSLETTER

VOLUME 11 ■ NUMBER 4 ■ NOVEMBER 1995

## India's Fight Against IDD: Reports from the Battlefield

India and China have more people affected by IDD than any other countries in the world. Large goiters and cretinism were recognized as commonplace in the Himalayan foothills for many decades. More recent information has shown that large parts of the rest of India are also iodine deficient. A survey of 239 of the country's 457 districts have shown 82% to be iodine deficient.

The government has tackled the problem by promoting the use of iodized salt and banning the use of non-iodized salt. This massive undertaking has been actively assisted by Dr. C.S. Pandav, ICCIDD Regional Coordinator for Southeast Asia, his colleagues at the All India Institute for Medical Science in Delhi and many other ICCIDD members in India, and by very strong support from UNICEF in Delhi, where ICCIDD Board members David Haxton and Rolf Carriere were formerly Regional Director and Advisor for Nutrition, respectively. The following pages present recent reports from the field.

*Using the salt testsing kit a at Phut-talao Primary School, M.P. "Look my salt sample has turned blue! My young sister will now get enough iodine from young age."*

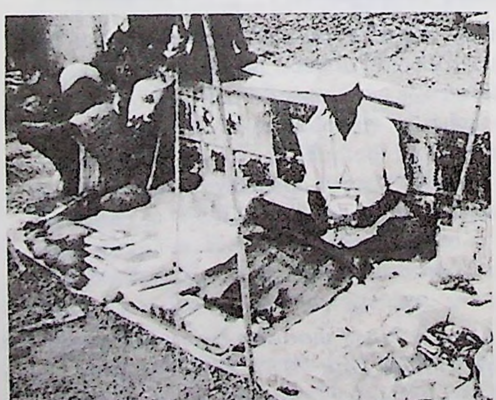
*Health worker explaining to the village mother "buy and use only iodized salt." Kalipura, M.P.*

# Madhya Pradesh's Efforts to Sustain IDD Elimination

Dr. C.S. Pandav, ICCIDD Regional Coordinator, visited the Bhopal, Indore, and Jhabua districts of Madhya Pradesh to report on progress against IDD. This article and the accompanying photographs are taken from the report prepared by Dr. Pandav and Ms. Nilima Chawla, ICCIDD Board member and ICCIDD's Communication Focal Point for South Asia.

In August 1994 the government of Madhya Pradesh (MP) established the Rajiv Gandhi Technology Mission for Eliminating Iodine Deficiency Disorders. Its purpose is to eliminate IDD by iodine supplementation for the entire 66 million people living in the state. Other missions also established to meet basic needs of rural people in the state include the Watershed Development Mission, the Shiksha Mission, the Mission for Control of Diarrheal Diseases, the Mission for Development for Rural Industries, the Mission for Development of Fisheries, and the Mission for Development of Advanced Technology. These missions represent the MP government's effort to prioritize certain "thrust areas" in development and make them a collective endeavor. Establishment of the missions received the strong support of the chief minister.

*Kalyanpur "hat" (weekly market) in M.P., "I only sell packaged iodized salt".*



*Kalyanpur "hat" (weekly market) in M.P., "I only sell packaged iodized salt".*

The mission has two clear goals: (1) to make communities aware of the need to use iodized salt, and (2) to ensure adequate distribution and sale of iodized salt. Community research had shown a very poor level of IDD awareness. To counter this, in January 1995 an IDD Elimination Week took place in every development block. Its components included a major information drive, house to house surveys to detect cases of IDD, and spot testing of all salt consumed by the community. Mass rallies and meetings were organized at 5,493 locations in 4,590 villages, with 1,543 exhibitions and films and 1,867 cultural shows. Salt was tested in 2,234 schools, 353,941 households were surveyed, detecting 10,362 IDD cases, and 255,360 salt samples were tested. After the IDD elimination week, four Rath Yatras (information vans), one each from Indore, Bhopal, Jamaipur, and Bilaspur, covered all the blocks of the state to spread the messages of iodized salt and oral rehydration therapy. With this highly visible and effective form of communication, along with the other channels used, the Mission successfully informed people that the additional cost of four rupees per month per family was a small price to pay to protect the family from iodine deficiency.

With regard to supply of iodized salt, communication efforts convinced the salt traders to promote iodized salt. By signing the Bhopal Declaration, they agreed they would not sell salt that was not iodized. The Nagarik Apoorti Nigam supplied iodized salt through public distribution outlets, and thus was able to quickly supplement the private salt trade. As a result, iodized salt comprises 84% of the salt consumed in the state. An independent evaluation will soon be conducted. The achievement in Jhabua is all the more remarkable because it is one of the most backward districts in Madhya Pradesh, with the lowest literacy rate (19%) in the country, an infant mortality rate of 141 and severe economic and social deprivation. A key feature in the success of iodized salt introduction has been the extensive educational efforts, including those in the schools. At the same time, the government administration established a close link with salt producers and retailers, thus fostering greater understanding and a sense of social responsibility. This won their partnership by cooperation rather than coercion.

## ON INDEPENDENCE DAY: FREE AT LAST!

Jhabua District, Madhya Pradesh: It is dawn on the 16th of August 1995. In the soft light of a could filled monsoon morning, streams of village children hurry to their schools, each carefully carrying a fistful of salt. For the first time in the school at Mindal, they are going to test the salt to see if it contains iodine. As they settle into their places, their faces reflecting their suspense, young Kali, the class monitor lines up all the salt samples in front of her. From a small plastic bottle she adds a drop of liquid to each pile of salt. Immediately the salt changes color, one turning dark blue, another becoming a light violet, while some stay the normal white of edible salt. "This salt that didn't turn blue is bad salt", she tells her classmates. "It doesn't have the iodine we need to keep our bodies strong and our minds intelligent. So I'm going to throw away this bad salt."

By throwing away the "bad" salt, Kali has symbolically encapsulated a silent revolution that is sweeping the tribal district of Jhabua. A revolution in which all the uniodized salt traditionally available to the people is being replaced with salt that contains iodine. It is only when they get iodized salt that the iodine-deficient population of this poor and underdeveloped district will be spared the mental retardation, stunting, deaf-mutism and birth defects caused by iodine deficiency.

— C.S. Pandav and N. Chawla


*Kali, the class monitor throwing away the non-iodized salt. "This salt that didn't turn blue is bad salt." Phut-talao Primary School, M.P.*

# Reviews/Analyses

## Administration of iodized oil during pregnancy: a summary of the published evidence*

F. Delange[1]

*This brief review of the available studies confirms that the administration of iodized oil before or during pregnancy prevents endemic cretinism and brain damage by correcting iodine deficiency and thyroid function in pregnant women, fetuses, neonates, infants and children. The potential benefits derived from using iodized oil immediately before or during pregnancy greatly outweigh the potential risks in areas of moderate and severe prevalence of iodine-deficiency disorders, where iodized salt is not yet available.*

The administration of iodized oil to entire populations, and especially to women of childbearing age and during pregnancy, has been proposed as an emergency prophylactic and therapeutic approach in areas with severe iodine deficiency complicated by endemic cretinism where universal salt iodization has not yet been successfully introduced (*1*). This procedure prevents brain damage due to iodine deficiency in the fetus and the neonate.

### Findings

Iodized oil programmes have conclusively been shown to be effective in preventing and treating endemic goitre, and also in preventing endemic cretinism (*2–13*) and the alterations of neuropsycho-intellectual development which are frequently encountered in non-cretinous individuals (*13–38*). However, adverse side-effects have been reported in non-pregnant adults due to the administration of iodine far in excess of physiological need. For example, in a pilot study of 14 subjects in the Solu region of the Nepalese Himalayas, Croxson and colleagues (*39, 40*) reported a significant fall in serum $T_3$ (triiodothyronine) and a rise in serum TSH (thyroid-stimulating hormone) concentrations over a period of 4–10 days (mean, 6 days) in 8 subjects with small goitres soon after receiving intramuscular (IM) injections of 400 mg of iodine in oil, which suggests an acute inhibitory Wolff–Chaikoff effect. In addition, three other subjects with large multinodular goitres developed biochemical hyperthyroidism. These findings in pilot studies are compatible with well-documented iodine-induced thyrotoxicosis which occurred in severely iodine-deficient populations following the introduction of iodine prophylaxis by iodized salt (*41–46*). There are a few reports of iodized oil-induced hyper- or hypothyroidism in public health programmes, sporadic cases of hyperthyroidism having been reported from Ecuador (*47*), Peru (*48*) and Argentina (*49*), but these were not detected in large-scale programmes in New Guinea (*2, 50*), Zaire (*6, 9, 12, 51*), Nepal (*38, 40, 52*), Algeria (*53*), Indonesia (*54, 55*) and China (*56, 57*). Since many of these interventions were conducted under particularly difficult environmental conditions, adverse reactions to therapy could easily have escaped detection (*58*).

In contrast, detailed studies have been carried out on the effects of iodized oil administered to women just before or during pregnancy with special attention to the short- and long-term side-effects of iodized oil on thyroid function in the mother, neonate, infant and child (*59*). In carefully executed studies in New Guinea on the effects of iodized oil administered before or during pregnancy to prevent endemic cretinism (*4, 11*), biological tests examining thyroid function were rarely available (*20, 22*) because of particularly difficult environmental condi-

* This article in based on material presented at a WHO Consultation on the Safety of Iodized Oil for Pregnant Women, Geneva, 13–14 September 1994. See also: Safe use of iodized oil to prevent iodine deficiency in pregnant women on pages 1–3 of this issue. Requests for reprints should be sent to Nutrition Unit, World Health Organization, 1211 Geneva 27, Switzerland.

[1] Department of Paediatrics, Hôpital Saint-Pierre, Brussels, Belgium.

Reprint No. 5679

Table 1: **Effects of iodized oil; given just before or during gestation, on the thyroid function of mothers, neonates, infants and children.**[a] The results are given as means ± SE except where otherwise indicated.

| Region and epidemiology | Protocol | Mothers at delivery | Neonates | Follow-up |
|---|---|---|---|---|
| ***North-eastern Algeria*** | | | | |
| Urinary iodine: 1.6 ± 0.5 µg/dl | Placebo-controlled randomized study ($n$ = 1536) | Urinary iodine: 1.8 µg/dl<br>TSH 4.1 mU/l | TSH 12.4 (mU/l);<br>$T_4$ 6.7 µg/dl | **Mothers:**<br>The abortion, prematurity and stillbirth rates were lower in the treated than in the untreated group ($P$ < 0.001) |
| Prevalence of goitre:<br>— global population: 53%<br>— pregnant women (visible goitre rate): 47% | Placebo ($n$ = 982) vs iodized oil ($n$ = 554) | | | None became hyperthyroid |
| Prevalence of cretinism: 1% | Iodized oil 0.5 ml (240 mg I) orally:<br>a) 1–3 months before conception ($n$ = 213) | Urinary iodine: 9.4 µg/dl[b]<br>TSH: 2.1 mU/l[b] | TSH: 4.9 (mU/l)[b];<br>$T_4$: 10.4 µg/dl[b] | At 6 months, urinary iodine remained twice higher and TSH twice lower in the treated lower in the treated group than in the controls respectively |
| | b) During the first month of gestation ($n$ = 190) | Urinary iodine: 10.1 µg/dl[b]<br>TSH: 2.1 mU/l[b] | TSH: 4.6 (mU/l)[b];<br>$T_4$: 11.0 µg/dl[b] | **Infants:**<br>The incidence of hypothyroidism was 2/982 in the untreated group and 0/554 in the treated group |
| | c) During the third month of gestation ($n$ = 151) | Urinary iodine: 9.8 µg/dl[b]<br>TSH 1.9 mU/l[b] | TSH: 4.6 (mU/l)[b];<br>$T_4$: 10.8 µg/dl[b] | Hypothyroidism was only transient |
| ***Ubangi area, northern Zaire*** | | <u>Untreated</u> ($n$ = 246) | <u>Untreated</u> ($n$ = 195) | **Infants + children:**<br><u>Untreated</u> |
| Urinary iodine: 15.5 ± 1.3 µg/day ($n$ = 243)<br>Prevalence of goitre:<br>— global population: 51%<br>— pregnant women: 75%<br>Prevalence of cretinism: 1–10% | Placebo-controlled, longitudinal, randomized study ($n$ = 983)<br><br>Placebo ($n$ = 484) vs iodized oil ($n$ = 499), 1 ml IM (480 mg I) during the last two trimesters of gestation (mean: 28th week) | Urinary iodine (µg/dl):<br>3.63 (3.30–3.99)[c]<br><5: 65%<br><2: 25% | | Urinary iodine (µg/dl): 0–84 months: stable 1.5–3.6 |
| Cord serum TSH >50 mU/l: 25%<br>Cord serum TSH >100 mU/l and $T_4$ <4 µg/dl: 14% | | Serum TSH (mU/l):<br>6.08 (5.64–6.56)[c]<br>$T_4$: 9.1 ± 0.3 µg/dl<br>$T_3$: 187 ± 5 ng/dl | Serum TSH (mU/l):<br>18.45 (16.52–20.60)[c]<br>$T_4$: 8.2 ± 0.3 µg/dl<br>$T_3$: 86 ± 5 ng/dl | Serum TSH >10 mU/l:<br>0–36 months: 46–49%<br>36–84 months: 59%<br>Serum $T_4$ (µg/dl), 0–84 months: low, stable<br>Overt clinical and severe biochemical hypothyroidism (endemic myxoedematous cretinism): 8.3% |

(Table 1: *continued*)

| | | | | |
|---|---|---|---|---|
| | | *Treated* (n = *256*)<br>Urinary iodine (µg/dl)<br>56.6 (51.3–62.5)[b,c]<br><5: 8%<br>>1000: 5%<br><br>Serum TSH (mU/l):<br>2.67 (2.49–2.86)[b,c]<br>$T_4$: 14.2 ± 0.3 µg/dl[b]<br>$T_3$: 154 ± 3 ng/dl[b] | *Treated* (n = *199*)<br><br>Serum TSH (mU/l):<br>7.19 (6.67–7.76)[b,c]<br>$T_4$: 11.2 ± 0.3 µg/dl[b]<br>$T_3$: 62 ± 3 ng/dl[b] | *Treated*<br>Urinary iodine (µg/dl):<br>0–12 months: 15.5<br>12–24 months: progressive decrease<br>>36 months: as low as in controls<br><br>Serum TSH >10 mU/l:<br>0–24 months: 5%<br>24–36 months: 40%<br>>36 months: as high as in controls<br>Serum $T_4$ (µg/dl):<br>0–24 months: normal (except 1)<br>24–48 months: progressive decrease<br>>48 months: as low as in controls<br>Endemic myxoedematous cretinism: 2.6% |
| ***Ntcheu district, Malawi*** | | | | |
| Urinary iodine: 3.3 ± 0.1 µg/dl<br>Prevalence of goitre: 59%<br>Prevalence of cretinism: 1% | Placebo-controlled randomized study (*n* = 627)<br><br>Placebo (*n* = 404) vs iodized oil 0.5 ml (240 mg I) IM or orally during the last trimester | *Untreated* (n = *404*)<br>Urinary iodine: 3.3 µg/dl<br>Serum TSH: 4.7 mU/l<br>$T_4$: 10.5 ± 3.4 µg/dl<br>$T_3$: 216 ± 76 ng/dl<br><br>*Treated by iodized oil IM* (n = *147*)<br>Urinary iodine: 28.5 µg/dl[b]<br>Serum TSH: 2.8 mU/l[b]<br>$T_4$: 12.8 ± 3.1 µg/dl[b]<br>$T_3$: 208 ± 87 ng/dl<br><br>*Treated by iodized oil orally* (n = *76*)<br>Urinary iodine: 12.3 µg/dl[b]<br>Serum TSH: 2.6 mU/l[b]<br>$T_4$: 12.5 ± 2.4 µg/dl[b]<br>$T_3$: 231 ± 70 ng/dl[b] | *Untreated* (n = *400*)<br><br>Serum TSH: 11.1 mU/l<br>$T_4$: 8.6 ± 2.3 µg/dl<br>$T_3$: 85 ± 54 ng/dl<br><br>*Treated by iodized oil IM* (n = *146*)<br><br>Serum TSH: 5.9 mU/l[b]<br>$T_4$: 10.5 ± 2.7 µg/dl[b]<br>$T_3$: 66 ± 10 ng/dl<br><br>*Treated by iodized oil orally* (n = *73*)<br><br>Serum TSH: 5.6 mU/l[b]<br>$T_3$: 9.7 ± 2.3 µg/dl[b]<br>$T_4$: 71 ± 16 ng/dl[b] | |

[a] Compiled from references *7–9*, *12* and *61–68*, and from J. Vanderpas & B. Swannen, personal communication.
[b] Significant difference compared with the untreated group ($P < 0.001$).
[c] These results are geometric means (–SEM; +SEM).

tions. Pharoah (*4*) reported very low levels of serum protein-bound iodine (PBI) in untreated mothers who delivered cretins, whereas normal values were still found in treated mothers who delivered normal infants 3–4 years after receiving iodized oil injections. Pretell and colleagues (*60*) reported that in an area of severe iodine deficiency in the Peruvian Andes (daily urinary excretion of iodine, 25 µg; prevalence of visible goitre, 52–59%; and prevalence of cretinism, 1.0–3.6%), umbilical cord serum $T_4$ (thyroxine) and free $T_4$ levels were much lower, and TSH levels higher, than in controls from an iodine-replete area. The results for the same variables were normal in neonates born to mothers injected with iodized oil before or during early pregnancy. No adverse side-effects were observed either in mothers or neonates.

The most detailed studies of iodized oil given during pregnancy have been conducted in Zaire (*7–9, 12, 61–65*), Algeria (*66, 67*) and Malawi (*65, 68*) in areas of severe iodine deficiency and endemic goitre, complicated by cretinism (Table 1). The doses of iodized oil were 1 ml IM (480 mg I) in Zaire, and 0.5 ml IM or orally in Algeria and Malawi. Time of administration varied from just before pregnancy in Algeria to the third trimester of gestation in Zaire. The result was a systematic and dramatic increase in maternal iodine supply, with only occasional iodine overload (5% of treated women in Zaire had urinary iodine levels above 1000 µg/dl at the time of delivery). Nevertheless, thyroid function in mothers, which frequently indicates hypothyroidism in the absence of therapy, was normal in all treated mothers at delivery; their serum TSH, $T_4$ and $T_3$ levels were similar to those observed in mothers in iodine-replete areas (*69, 70*). In addition, not a single woman exhibited biochemical evidence of hyperthyroidism and the prevalence of goitre markedly decreased in those who had been treated.

In the absence of therapy for mothers, thyroid function was severely impaired in a large number of neonates (in the Ubangi area of Zaire, 14% of infants had cord serum TSH above 100 µU/ml and $T_4$ below 4 µg/dl). The extent of deviation from normal values in infants was more severe than in mothers and was directly related to the severity of the iodine deficiency and hypothyroidism present in mothers. Once again, iodized oil administered to mothers entirely normalized the thyroid function in neonates, and the correction occurred regardless of the stage of pregnancy — from the first month to late in the third trimester — at the time of therapy.

In seven years of follow-up after treatment of mothers with iodized oil, no case of hyperthyroidism was reported in either mothers or children. Depending on the dose and the stage of pregnancy at which it was given, the status of iodine nutrition of infants and children (evaluated by ascertaining urinary iodine concentrations) progressively deteriorated with age, reverting to the degree of iodine deficiency found in untreated individuals from the age of 2 years onwards. Nevertheless, clinical and biochemical hypothyroidism was largely prevented in infants born to treated women, and when they occurred, they were frequently transient in nature. Finally, treating pregnant women with iodized oil resulted in decreased incidence of abortions, prematurity and stillbirths, and an increased birth weight.

These positive results stand out in contrast to the interpretation of the results of a single study, which has frequently been reported in the literature in the last decade (*20, 71–74*). The study was conducted in parts of Bhutan and India known for severe iodine deficiency (more than 50% of the population with urinary iodine/creatinine ratio below 25 µg/g creatinine and goitre prevalence varying from 60% to 80%). Iodized oil (1 ml IM) was administered to schoolchildren, women of reproductive age, and pregnant women. Cord serum TSH and $T_4$ were measured in a group of 154 neonates born to mothers who had been injected during the second half of the third trimester of pregnancy (mean of 3.5 weeks before delivery). Selection criteria for neonates and the range of the time interval between injection and delivery were not reported. Sixteen of the 154 infants (10.4%) had cord serum TSH above 50 mU/l and cord $T_4$ below 3 µg/dl, indicating neonatal biochemical hypothyroidism. The investigators concluded that the iodized oil administered during pregnancy induced thyroid failure in the neonates, and consequently that oil therapy should be rejected as a prophylactic measure during pregnancy.

This interpretation is seriously to be questioned for two reasons. First, in the absence of results for urinary iodine in mothers, there is no evidence that the mothers were indeed injected and were iodine overloaded. Second, and more important, the same incidence of neonatal biochemical hypothyroidism (7.5–13.3%) was reported in the study areas in the absence of an iodized oil programme. Consequently, the study provides no evidence that the iodized oil administered to pregnant women had adverse effects on the neonates.

## Conclusion

Detailed studies provide conclusive evidence that the administration of iodized oil prior to, or during, pregnancy prevents endemic cretinism and brain damage by correcting iodine deficiency and thyroid function in pregnant women, fetuses, neonates, infants and children. To prevent neurological damage, it is crucial that iodine deficiency be corrected before or during early gestation. Correction of maternal, fetal and neonatal hypothyroidism can occur at any time during pregnancy, including the last trimester. The duration of postnatal correction of thyroid function depends on the dose of iodized oil administered to the mother, e.g., about two years for 1 ml iodized oil administered orally or IM, but only 6 months for half this dose. Despite the massive doses of iodine administered, no iodine-induced thyroid function abnormalities have ever been conclusively demonstrated at the time of delivery or in the short- or long-term follow-up of pregnant women and their offspring. The potential benefits derived from using iodized oil immediately before or during pregnancy greatly outweigh the potential risks in areas of moderate and severe prevalence of iodine-deficiency disorders, where iodized salt is not available or unlikely to be available within 1–2 years.


## Résumé

### Administration d'huile iodée pendant la grossesse: résumé des études publiées

Des études détaillées montrent de façon concluante que l'administration d'huile iodée avant ou pendant la grossesse contribue à prévenir le crétinisme endémique et les lésions cérébrales en corrigeant la carence en iode et la fonction thyroïdienne chez la femme enceinte, le fœtus, le nouveau-né, le nourrisson et l'enfant. Pour prévenir les lésions neurologiques, il est essentiel de corriger la carence en iode avant la grossesse ou au début de celle-ci. La correction de l'hypothyroïdisme maternel, fœtal et néonatal peut se faire à n'importe quel moment de la grossesse, même au cours du dernier trimestre. La durée de la correction post-natale de la fonction thyroïdienne dépend de la dose d'huile iodée administrée à la mère; elle est par exemple d'environ deux ans après administration de 1 ml par voie orale ou intramusculaire, mais seulement de six mois pour 0,5 ml. En dépit des doses massives d'iode qui ont été administrées, aucune anomalie de la fonction thyroïdienne induite par cet élément n'a été démontrée de façon concluante au moment de l'accouchement ou ultérieurement chez les femmes enceintes et leurs enfants qui ont fait l'objet d'un suivi à court ou à long terme.

Les avantages potentiels de l'administration d'huile iodée immédiatement avant la grossesse ou au cours de celle-ci compensent largement les risques potentiels dans les régions où la prévalence des troubles dus à une carence en iode est modérée à forte et où l'on ne prévoit pas de distribution de sel iodé avant un an ou deux.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Original Article

Indian J Pediatr 1996; 63 : 105-110

# Iodine Deficiency Disorders in Bangladesh

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**Abstract.** An extensive iodine deficiency disorders survery was conducted in Bangladesh in 1993 to assess the latest iodine nutriture status of the country. The clinical variables of the survey were goitre and cretinism, and the biochemical variable was urinary iodine. The "EPI-30 cluster" sampling methodology was followed for selecting the survey sites. In each survey site, the study population consisted of boys and girls, aged 5-11 years, and men and women, aged 15-44 years, in about equal populations. the total number of survey sites was 78 and the total number of respondents was 30 072. The total number of urine samples was 4512 (15% sub-sample). The current total goitre rate (grade 1 + grade 2) in Bangladesh is 47.1% (hilly, 44.4%; flood-prone, 50.7%; and plains, 45.6%). The prevalence of cretinism in the country is 0.5% (hilly, 0.8%; flood-prone, 0.5%; and plains, 0.3%). Nearly 69% of Bangladeshi population have biochemical iodine deficiency (urinary iodine excretion [UIE] < 10 mg/dl) (hilly, 84.4; flood-prone, 67.1%; and plains 60.4%). Women and children are more affected than men, in terms of both goitre prevalence and UIE. The widespread severe iodine deficiency in all ecological zones indicates that the country as a whole is an iodine-deficient region. Important recommendations of global interest are made from the experience of the survey. **(Indian J Pediatr 1996; 63 : 105-110)**

***Key words :*** *Iodine-deficiency disorders; Goitre; Cretinism; Urinary iodine.*

Iodine deficiency disorders (IDD) are recognized as a major global public health problem today. An estimated number of 1.57 billion people world wide are at risk of IDD, 655 million are goitrous, and about 20 million suffer from varying degrees of mental handicap related to iodine deficiency.[1,2] In fact, iodine deficiency is the single most preventable cause of neurological and intellectual impairment (cretinism).[3,4]

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Bangladesh is the largest delta in the world. Three major rivers, the Padma (downflow of the Ganges) flowing from the west, the Jamuna (downflow of the Brahmaputra) flowing from the north and the Meghna, flowing from the north-east form this huge delta. Ecologically, the country has three different zones, namely the hilly zone, the flood-prone zone and the plain zone. Flooding is almost an yearly phenomenon. Also, the country experiences heavy rains; yearly rainfall ranges from 1200 to 2400 mm.[5]

The annual flooding and heavy rains constantly wash the soil off iodine. The cumulative yearly loss of iodine from the soil makes the country extremely vulnerable to the dangers of iodine deficiency as is the case with other countries in the valley plains of the Himalayas-Bhutan, Nepal annd Northern India.

The pioneering nutrition survey of the then East Pakistan of 1962-64[6] and the subsequent national goitre prevalence study of 1981-82[7] showed prevalence of goitre to the extent of 10.5 to 28.9%, with highest prevalence rates being in the basin areas of the above major rivers.

In view of repeated annual flooding, heavy rains and continued deforestation, all of which are likely to aggravate the risk of IDD, a coomprehensive IDD survey was done in the country in 1993. In this survey, besides goitre, urinary iodine level was measured and cretinism was assessed for the first time in this country.[8] The present paper describes the details of the key findings of the survey.

## Material and Methods

*Study design.* For the purpose of the survey, the country was divided into three ecological zones-the hilly, flood-prone, and the plains. Flood-prone areas were those which experience flood frequently, than at least 5 times in last 10 years. Areas lying more than 300 meters above the sea level (Chittagong and Chittagong Hill Tracts) were categorized as the hilly zone. The remainder of the country was categorized as plain land.

There are 477 "*thanas*" in Bangladesh according to the 1981 census report. Of these, a total number of 106 *thanas* were identified to be of mixed type, i.e. flood-prone/hilly/plains. These were excluded from the survey. In 39 "*thanas*" (of which 7 were of mixed type), UNICEF had been carrying out a lipiodol injeection programme for several years since 1986. These *thanas* were excluded from the present study. In addition, all 13 *thanas* of the Chittagong Hill Tracts were also excluded due to speciial circumstances prevailing in these areas. Thus, in all, 151 *thanas* [106 + 32 (= 39-7) + 13] were excluded from the study. The distribution of the remaining 326 *thanas* was as follows :-plains : 251 *thanas*; flood-prone : 69 *thanas*; and hilly : 6 *thanas*. All these 326 "*thanas*" from the respective ecological zones thus constituted the universe for sampling purpose.

*Sampling procedure.* The study population (respondents) consisted of male and female children in the age group of 5-11 years and male and female adults in the age group of 15-44 years. Based on the prevalence rate estimate (50%), confidence interval (95%), relative error (± 5%) and appropriate design effect, it was decided to examine 100 people in each of the four groups mentioned above, i.e. 400 (100 x 4) respondents from each "*mauza*". The "EPI-30 cluster" sampling methodology as recommended by the Joint WHO/ UNICEF/ICCIDD Consultation of IDD Indicators[9] was followed for selecting the survey sites from the flood-prone and the plain zoones. Thus 30 *thanas* were selected each from these two zones, as the primary sampling units, according to probability proportional to population size. From each *thana*, one "*mauza*" (defined area generally equivalent to a village) was selected randomly, as the secondary sampling unit. In view of limited accessibility, scarce population and time consstraints, the small hilly zone was considered as a spcial area. From this zone, 18 *mauzas* were selected randomly. Thus the total number of survey locations in the whole country was 78.

*Study population.* In each *mauza*, the study population consisted of four different population groups (boys and girls, aged 5-11 years and men and women, aged 15-44 years) from 100 households (ultimate sampling units) selected by a systematic random method. The total number of respondents was 30072 (96.4% of target) in about equal proportions. For collection of urine samples, 15% of the households were selected randomly from each *mauza*. The total number of urine samples collected was 4518 which met the estimated target number.

*Clinical examinations.* The clinical examinations for goitre and cretinism were performed by MBBS doctors specially recruited and trained for the survey. Grading of goitre was done according to the criteria recommended by the Joint WHO/UNICEF/ICCIDD[9] (grade 0, no goitre; grade 1, thyroid palpable but not visible; and grade 2, thyroid visible with neck in normal position). When in doubt, they were asked to record the immediate lower grade. Intra and inter-observer variation was controlled by repeated training and random examinations of goitre grades by the experts. In addition, a validation exercise was carried out by international experts. Cretin cases were identified on the basis of history and clinical manifestations of obvious mental retardation, dwarfism, deaf-mutism, squint and disturbed gait. The results were recorded in a pre-designed questionnaire.

*Biochemical investigation : iodine in urine.* On-the-spot urine samples were collected from t he randomly selected respondents in wide mouthed screw capped plastic bottles. (One drop of toluene was added to each sample to inhibit bacterial growth and to minimize bad odour.) Iodine was determined by the wet digestion method adopted by Gutekunst.[10] The results were expressed as μg iodine/dl urine. The data was entered into the relevant questionnaires.

*Validation of urinary iodine analysis.* Urinary iodine levels were determined by expert faculty members. The validation of these analyses was carried out by both internal as well as external quality assurance programmes. The PAMM/CDC (Program Against Micronutrient Malnutrition/Centre for Disease Control) laboratory at Emory University, Atlanta, GA, USA helped to conduct the external assurance.

*Data management and statistical analysis.* All questionnaires were manually edited and coded. The data entry was done by using a software dBase III + with range checking and appropriate correction. Significance of difference in values of different groups was analysed by Chi-square, Mann-Whitney and other tests.

## Results

### Goitre Prevalence

The findings of the survey on goitre prevalence in the three ecological zones are given in Tables 1 to 3. In the plain zone (Table 1), total goitre rates (TGR) (grade 1 + grade 2) in the four population groups (boys, girls, men and women) were found to be 46.0%, 52.0%, 34.2% and 51.3% respectively. Thus, the children and the adult women were more affected than the adult males. The overall goitre prevalence in this zone was 45.6% (36.2% palpable + 9.4% visible). In the flood-prone zone (Table 2), TGR in the four population groups were found to be 50.5%, 55.8%, 36.7% and 59.8% respectively. Here also, the children and particularly the adult women were worst affected. The overall TGR in this zone was found to be 50.7% (44.5% palpable + 6.2% visible).

The overall prevalence of goitre in the hilly zone is 44.7% (33.4% palpable + 11.3% visible). In this zone, the prevalence of both palpable and visible goitre in the adult females was double than that in the adult males (Table 3).

The overall goitre prevalence in the country as a whole, calculated from total population of Bangladesh and age and sex distribution of the study populations was found to be 47.1% (38.3% palpable + 8.8% visiible) (Fig. 1). In many areas of each zone, goitre prevalence was found to even exceed 90%. These are the worst affected 'pocket' areas which warrant immediate intervention.

**Urinary Iodine Excretion**

The median urinary iodine excretion (UIE) in the study population was found to be the lowest in the hilly zone (3.4 μg/dl), followed by the flood-prone zone (5.1 μg/dl) and the plain zone (7.4 μg/dl) (Table 4). The median UIE was thherefore lower than the accepted cut-off level of 10 μg/dl all over the country.[11] The females of both age groups had significantly lower UIE than the males (Table 4), with more than one-quarter of them having UIE less than 2 μg/dl.

Distribution analysis shows that 84.4% of the population in the hilly, 67.1% in the flood-prone annd 60.4%5 in the plain zone were having biochemical iodine deficiency (UIE < 10 μg/dl) (Table 4). The national figure for this stood at 68.9% (Fig. 1).

**Cretinism**

Prevalence of cretinism in the country was found to an extent of 0.5%. Zone-wise, the cretinism rates were 0.8% in the hilly, 0.5% in the flood-prone and 0.3% in the plain zone (Table 5). There were more child cretin cases than adult, and unlike goitre prevalence, cretinism was more prevalent in the males than in the females.

## Discussion

Results presented in the present paper are the summary of the key findings of the National IDD Survey in Bangladesh—1993. This is the first comprehensive IDD survey conducted in this country, in which, in addition to goitre assessment, urinary iodine was also measured to ascertain biochemical iodine nutriture status of a sub-sample of the study population. Cretinism was also assessed in the survey, on the basis of obvious clinical symptoms, as a second priority objective of the survey.

The application of the 'EPI-30 cluster' methodology followed in the present Naional IDD Survey for selection of suurvey sites may be considered as a pioneering effort. Goitre grading was validated by national and international experts. The inter-team variations were minimal and agreement with respect to the overall grading was 82.6%. The results of urinary iodine analysis were validated by satisfactory internal as well as external quality assurance tests.

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Since the survey was conducted on the basis of ecological zones (hilly, flood-prone and plains), the results are also presented zone-wise. Contrary to our expectation, results showed that total goitre rate (TGR) was high in all three zones of the country and clinically there was no significant difference in TGR of these zones.

However, in terms of median urinary iodine level, percent population having biochemical iodine deficiency and also prevalence rates of cretinism, the ecological zones differed from each other and could be presented in increading degree of severity as plains < flood-prone < hilly. This may indicate that IDD in the hilly zone is old while that in the other zones is relatively a more recent phenomenon.

The results obtaiined from the present survey show that IDD situation in Bangladesh is severe. From the widespread severe IDD in all three ecological zones, we suspect that Bangladesh as a whole is an iodine-deficient region and that 100% of its population are at risk of iodine deficiency. fortunately, the government of Bangladesh, with assistance from UNICEF, has initiated a universal salt iodization programme to solve the IDD problem.

One interesting observation emerged from the present survey. In all the three zones, the total goitre rate or urinary iodine level in the children was comparable to that in the adults, although large variations existed among the adult males and females. For example, in the hilly zone, TGR (total goitre rate) in boys and girls were 43.4% and 50.4% respectively (overall 46.8%) and TGR in men and women were 27.2% and 56.1% respectively (overall 42.9%). Similar results are seen in the other zones. Same is true for median urinary iodine level and the percent population having biochemical iodine deficiency (see Results).

The above findings lead us to draw an important conclusion-IDD surveys carried out in children can be considered as representative of the whole community. Therefore, for future IDD surveys, children aged 5-11 years should be examined.

In the present survey, the school attendance pattern of the school-aged children was the same irrespective of whether they had goitre or not (data not shown). Thus, for countries where primary schooling is universal, quick school-based surveys (80-100 children per cluster) are recommended instead of household surveys. This would substantially reduce the time and cost of an IDD survey.

## Acknowledgements

This work was financially supported by the United Nations Children's Fund (UNICEF) and the Canadian International Development Agency (CIDA). We would like to express our sincere thanks to UNICEF Country Representative, Bangladesh Mr Rolf C Carrier and his team for their support. We are grateful to Dhaka University authority, particularly its Vice-Chancellor Professor Emajuddin Ahamed, for providing us with all administrative and logistic support in conducting the survey.

We would like to thank our field team leaders Dr. M. Solyman, Dr. Moin Ahmed, Dr. Syed I. A. F. Siddique, Dr. Shamsul Muquarrabin, Dr. Tanvir Hossain, Dr. M. Asad Hossain, Dr. Shariful Islam Mondol annd Dr. Mamnunur Rahman Mamun for their hard work and sincere efforts in assessing IDD status of the study population. The invaluable assistance provided by the field technicians Humayun Kabir, Zulfikar Ali Bhutto, Masud Shakil, Iqbal Hossain, Jahangir Alam, Monowar Hossain, Ershadul Hoque, Akhter Hossain and Mahbubul Alam is acknowledged with utmost appreciation. The expert technical laboratory assistance of M. Omar Faruque, M. Ayub Khan and Taslima Ferdausi is also gratefully acknowledged.

We are grateful to Professor M.G. Karmarkar (Senior Advisor, ICCIDD) of All India Institute of Medical Sciences, New Delhi, India and Dr. G.F. Maberly of the Centre for International Health at Emory University School of Public Health, Atlanta, GA, USA, for their assistance respectively with internal and external quality assurance of uriinary iodine analysis. Special thanks are also due to Mr. M. Yeakub Patwary, Consultant, UNICEF-Dhaka for his invaluable help in many aspects of the survey.

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# Update / Le point

## Safe use of iodized oil to prevent iodine deficiency in pregnant women*

A Statement by the World Health Organization[1]

*The risks and expected benefits from iodized oil, given orally or by injection, to pregnant women in areas of severe iodine deficiency where iodized salt is not available were evaluated. The conclusions, which were approved by the International Council for Control of Iodine Deficiency Disorders (ICCIDD), showed that for preventing and controlling moderate and severe iodine deficiency, the giving of iodized oil is safe at any time during pregnancy. Maximum protection against endemic cretinism and neonatal hypothyroidism will be achieved when iodized oil is given before conception. The potential benefits greatly outweigh the potential risks in areas of moderate and severe iodine deficiency disorders, where iodized salt is not available and is unlikely to be made available in the short term (1–2 years).*

### Introduction

Since salt iodization is the optimal way of correcting iodine deficiency, it should continue to be the primary focus, through sustainable programmes, for preventing and controlling iodine deficiency disorders (IDD).[a] The level of iodization should be adjusted to provide the recommended dietary intake (RDI) of iodine in the quantity of salt usually consumed. For pregnant and lactating women the RDI for iodine is 200 µg/day (*1*).

Pending successful establishment of salt iodization in areas of moderate and severe iodine deficiency,[b] periodic large doses of iodine are frequently administered to all women of childbearing age, orally or by injection, in the form of slowly resorbable iodized oil. This intervention is an effective short-term public health approach that prevents goitre and iodine-related brain defects, including endemic cretinism, in children. There are, however, a number of doubts about the safety of using iodized oil, or daily doses of iodine far in excess of normal physiological need, to prevent IDD. For example, maternal iodine overload due to iodized oil during the crucial period of pregnancy could inhibit maternal thyroid function through a Wolff–Chaikoff effect,[c] thereby decreasing the availability of thyroxine to the fetus. Iodized oil could also directly affect fetal development. In addition, it has been suggested that iodized oil administered during late gestation could impair fetal and neonatal thyroid function, also through a Wolff–Chaikoff effect (*2*).

Responding to these concerns, the World Health Organization convened a group of experts to review and evaluate the results of programmes providing iodized oil to pregnant women. A careful review of the literature, and of experiences in several countries where iodized oil has been given at various stages of gestation, indicates that negative results

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* A French translation of this article will appear in a later issue of the *Bulletin*.

[1] Based on a WHO Consultation on the Safety of Iodized Oil for Pregnant Women, Geneva, 13–14 September 1994. The participants at this meeting were Dr M. Benmiloud (*Chairman*), Algiers, Algeria; Dr F. Delange, Brussels, Belgium; Dr C.S. Pittman, Birmingham, AL, USA; Dr S. Yaffe, Bethesda, MD, USA; Dr C. Thilly, Brussels, Belgium; Dr C. Voumard, United Nations Children's Fund (UNICEF), Geneva, Switzerland. *WHO Secretariat:* Dr G. Clugston, Dr B. Underwood, Dr K. Bailey, and Dr J. Zupan. Requests for reprints should be sent to the Nutrition Unit, World Health Organization, 1211 Geneva 27, Switzerland.

Reprint No. 5665

[a] *Iodine and health: eliminating iodine deficiency disorders safely through salt iodization.* A statement by the World Health Organization. Unpublished WHO document WHO/NUT/94.4, 1994 (available in English, French and Spanish).

[b] Moderate and severe iodine deficiency are defined in: *Indicators for assessing iodine deficiency disorders and their control through salt iodization.* Unpublished WHO document WHO/NUT/94.6, 1994 (available in English, French and Spanish).

[c] The Wolff-Chaikoff effect is the inhibitory effect exerted by excess iodine on the iodization of tyrosines in hormone synthesis.

have not been convincingly demonstrated.[d] The group concluded that, for purposes of preventing and controlling moderate and severe iodine deficiency, as defined by WHO,[b] the administration of iodized oil is safe at any time during pregnancy. Maximum protection against endemic cretinism and neonatal hypothyroidism will be achieved when iodized oil is given before conception. During the first trimester of pregnancy the supply of thyroid hormone to the human fetus appears to be critically dependent on maternal thyroid status. This relationship has been conclusively demonstrated in animals (3).

The group concluded that the available evidence conclusively demonstrates that iodized oil administered to women before, or at any time during, gestation has no harmful side-effects. Moreover, iodized oil not only prevents endemic cretinism and mental retardation in infants due to iodine deficiency, but also decreases fetal and perinatal mortality and increases the birth weight.

## Prevention schedules and criteria

Dosage levels and frequency of administration, and the duration of protection expected from each are set out in Table 1. The dose selected and frequency of administration should be the lowest that will ensure protection throughout pregnancy, and during lactation for at least the first year postpartum. The dose that is compatible with the circumstances should be selected, and repeated if necessary, to ensure the desired degree of protection.

Table 1: **Dosage, frequency, and duration of effectiveness of administering iodized oil to fertile women of childbearing age**[a]

| | Intramuscular[b] | Oral[c] | Oral[c] |
|---|---|---|---|
| Frequency, based on duration of effect | >1 year | 12 months | 6 months |
| Pregnant women | 1 ml | 300–480 mg | 100–300 mg |
| Non-pregnant fertile women[d] | 1 ml | 400–960 mg | 200–480 mg |

[a] Adapted from the International Council for Control of Iodine Deficiency Disorders (ICCIDD).
[b] Lipiodol (ultra fluid): 1 ml contains about 480 mg iodine.
[c] Oriodol: 1 dose (0.57 ml) contains about 300 mg iodine. Lipiodol (capsule): 1 capsule (0.4 ml) contains about 200 mg iodine.
[d] Available data indicate that a dose of 100–200 mg orally protects for 3 months. No such data are available for pregnant women.

### *Criteria for giving iodized oil to pregnant women*

Programme planners should carefully review the circumstances calling for the introduction or continuation of iodized oil supplementation programmes. The use of iodized oil for pregnant women and women of childbearing age should be considered only in situations where:

- the prevalence of iodine deficiency disorders is classified as moderate or severe;
- cretinism and neonatal hypothyroidism are present; and
- universal salt iodization programmes will not reach women of reproductive age within 1–2 years (which usually occurs in small areas within countries or regions, thus requiring area-specific interventions).

The reasons why iodized salt will not be available within a year or two should be thoroughly investigated before selecting iodized oil as a public health intervention. Sometimes salt iodization programmes in highly endemic areas cease functioning for unavoidable reasons. Should they be unable to restart soon, iodized oil may serve as a useful temporary measure.

### *Monitoring*

The decision to use iodized oil for women of childbearing age should be made wherever the above criteria are met. Assessment of these criteria these requires baseline information on the distribution and severity of IDD, and on the availability of iodized salt throughout the area, country or region concerned. Assuming that the necessary baseline information is available, a monitoring system is required to evaluate both the programme's efficiency and its biological effectiveness. The system should include sufficient numbers of pregnant women to provide valid data for evaluation purposes and should be established within the context of national IDD control programmes.

*Optimal* biological and process indicators for effective monitoring of programmes to prevent fetal brain damage using iodized oil are given below.

***Biological indicators.*** These apply to infants and mothers.

[d] See article on pages 99–106 of this issue of the *Bulletin* (Delange F. Administration of iodized oil during pregnancy: a summary of the published evidence).

• *Infant*
— birth weight;
— perinatal mortality rate;
— neonatal serum thyroid-stimulating hormone (TSH).

• *Mother*
— urinary iodine concentration;
— breast-milk iodine concentration.

At least one of the indicators should be neonatal TSH or maternal urinary iodine.

***Process indicators.*** These include the following:
— availability of iodized oil at distribution points;
— system in place for registering and tracking the doses given;
— proportion of a programme's eligible subjects seen antenatally who have received iodized oil;
— system in place to determine pregnancy outcomes.

## Conclusion

Based on the available scientific and programmatic evidence, the proposed iodized oil prevention schedule in this statement will lead to no detectable adverse effects on human health. The potential benefits to be derived greatly outweigh the potential risks in areas of moderate and severe IDD prevalence where iodized salt is not available, and is unlikely to be made available in the short term, i.e., within 1–2 years.

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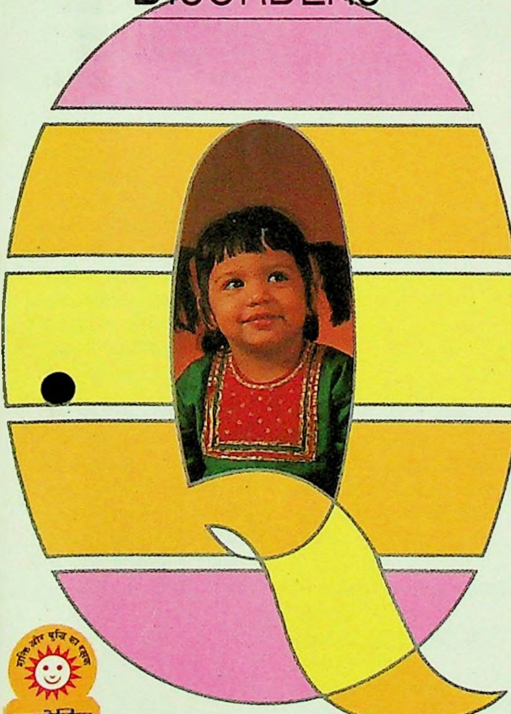
# 20 QUESTIONS ON IODINE DEFICIENCY DISORDERS



आयोडीन नमक

# PREFACE

It is now known that one out of every five people in India lives in identified iodine-deficient areas and is at a risk of being affected by Iodine Deficiency Disorders. These disorders, all caused by a lack of iodine in the diet, can range from goitre, mental retardation, and physical subnormality to cretinism. The majority of these disorders are permanent and incurable. However, each one of them is completely preventable. Iodated salt, consumed daily, offers complete protection against all iodine deficiency disorders, at an annual cost per person that is less than the price of a cup of tea.

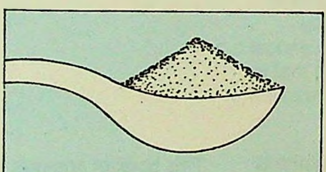
To enable everyone to include iodine in their daily diet, a number of salt iodation plants have been set up, and in the near future iodated salt will be available in every town and village of India.

This booklet answers some common questions about iodine deficiency. If you have any further questions, please write to :

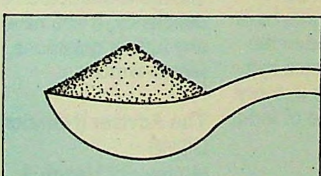
The Adviser (Nutrition)
DGHS
Ministry of Health &
Family Welfare,
Nirman Bhawan,
New Delhi-110011.

## What is Iodated (Iodised) Salt?

Iodated or iodised salt is used to prevent iodine deficiency disorders. It is common salt containing traces of an iodine compound. Iodated salt looks, tastes and smells exactly like ordinary salt and it should be used in the same way.



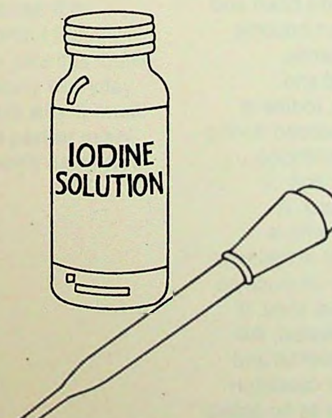
Iodated Salt



Common Salt

## What is Iodine?

Iodine is a natural element which is essential to human life. Some of the most vital functions of the human body depend upon a steady supply of iodine.



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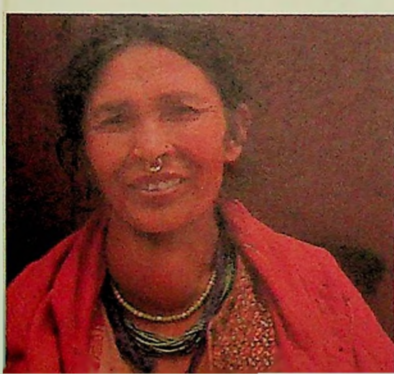
## From where do we normally get Iodine?

Iodine is present in its natural state in the soil and in water. So our normal requirement comes from crops grown on iodine-rich soil. But when the soil of any area lacks iodine, the crops too are deficient in this essential nutrient. Consequently, those people who live on iodine-deficient land and eat its crops regularly, do not get their daily requirement of this essential element.



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## What happens if a person does not get enough Iodine?

Goitre is only one of the many consequences of iodine deficiency. A number of physical and mental abnormalities, some serious, some mild, result from iodine deficiency.

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## What exactly is a Goitre?

A goitre is a swelling of the neck caused by an enlarged thyroid gland. When the body does not get enough iodine, the thyroid increases in size. Not all goitres are visible. Many of them, particularly in the early stages, can be detected only by an experienced doctor. It is only when a goitre grows quite large that it can be seen and recognised by everyone. A person with a goitre may also have other hidden iodine deficiency disorders.

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## What are Iodine Deficiency Disorders (IDD)?

Iodine Deficiency Disorders (IDD) form a spectrum of abnormalities which include goitre, mental retardation, deaf mutism, squint, difficulties in standing or walking normally and stunting of the limbs. Iodine-deficient women frequently suffer abortions and still-births. Their children may be born deformed, mentally deficient or even cretins. All these problems are caused by a simple lack of iodine, and goitre is the least tragic of them.

## Why does a child become a Cretin?

A baby growing in the mother's womb needs a steady supply of iodine for the normal growth and development of its brain and body. Only the mother's body can provide this essential iodine. But if the mother is iodine-deficient, the child too is deprived of this much-needed nutrient. If the woman's deficiency is severe, the child's brain and body are seriously and permanently stunted, and he becomes a cretin, unable to walk, talk or think normally. If the mother's deficiency is minor, the child will still be affected, even though he may look normal. The damage to his brain usually shows up years later in poor school performance and an inability to perform normal, everyday tasks. Millions in our country suffer from this form of iodine deficiency and it affects the social and economic progress of whole regions.



## Where does IDD occur in India?

The areas of severest iodine deficiency lie in the great sub-Himalayan belt that extends from Jammu and Kashmir, all along North India, to the North East, covering an area of 2500 square kms. But IDD has also been reported from Maharashtra, Gujarat, Madhya Pradesh, Andhra Pradesh, Orissa, Karnataka, Kerala, Tamil Nadu, Goa, Rajasthan, West Bengal and Delhi. In fact, no state in India is free from IDD and new pockets of iodine deficiency are being discovered every day.

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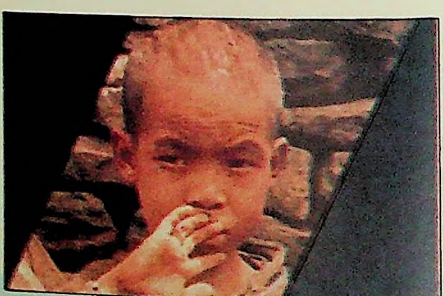
## Can the daily consumption of Iodated Salt cure Goitre, Cretinism and other Iodine Deficiency Disorders?

Cretinism is permanent and incurable. Like many other iodine deficiency disorders, with the exception of certain types of goitre, it cannot be cured but it can be easily prevented before it occurs. The regular consumption of iodated salt provides protection to present and future generations against the tragic consequences of iodine deficiency disorders.



# 12

## Are there any special foods that I can eat which are rich in Iodine?

Except for certain types of seaweed, there are no foods that are inherently rich in iodine. All food derives its iodine from the soil on which it grows. If the soil is poor in iodine all the food grown on it will be low in iodine. Therefore in areas of iodine deficiency, the only way to ensure a steady intake of essential iodine is by adding it to the diet in the form of iodated salt.

## 13

### Why is Iodine added to salt? Can't it be taken separately, like medicines?

An important fact about iodine is that although it is needed in tiny amounts, it is needed regularly, every day. While it could be taken every day like medicine or a vitamin tablet, this would involve taking a tablet every day for the rest of your life. Salt, however, is something that we all use every day. All of us eat roughly the same amount of salt — 10 to 15 grams a day, and if it is iodated, we automatically get the right amount of iodine.


## 14

### But if I live in an area that is not Iodine-deficient, won't the extra Iodine in the salt harm me?

No, it will not. All of us need only a certain amount of iodine to function normally. If this iodine is already available to the body, it will simply reject any additional quantities and excrete it unused through the urine. On the other hand, if you are deficient in iodine, your thyroid gland will use as much iodine as it needs and reject the rest. This makes iodated salt safe for everyone.

**Remember iodine is an essential nutrient — not a medicine.**

# 15 Q

## Can Iodated Salt be used by pregnant women, very young children or someone who is ill? Is it like ordinary salt?

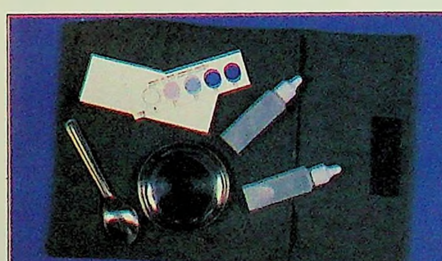
Yes. Every person — young, old, sick or healthy — needs iodine every day. Pregnant women and young children need it even more than others, so it is not only safe but also necessary for them to use iodated salt every day.

# 16 Q

## How can I tell if salt contains Iodine?

Sale of non-iodated salt has been banned in U.P., Bihar, Himachal Pradesh, J&K, Punjab, Haryana, Chandigarh, Delhi, Sikkim, Assam, Arunachal Pradesh, Mizoram, Meghalaya, Manipur, Nagaland, Madhya Pradesh, Tripura, West Bengal, Daman & Dui, Dadra & Nagar Haveli and Lakshdweep, parts of Maharashtra, Andhra Pradesh, Gujarat, Karnataka and Orissa.

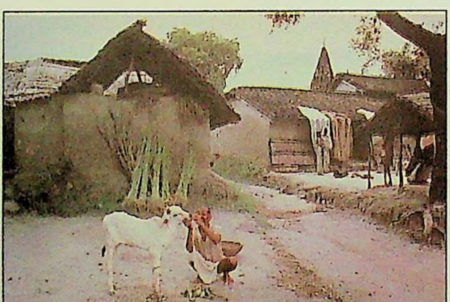
A low cost testing kit is available which allows you to test for the iodine content of the salt on the spot.



# 17

## Is it possible to use Iodated Salt for livestock?

Yes. Iodated salt improves the health and productivity of animals and reduces the number of still births and miscarriages. Also, cattle who are fed iodated salt produce milk that is rich in iodine.

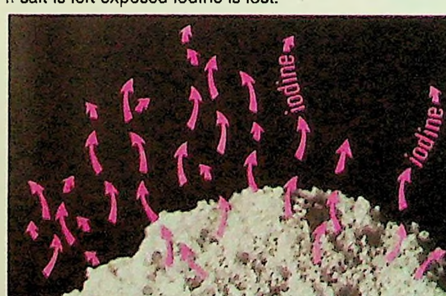


# 18

## Can Iodated Salt be stored like normal salt?

Storing iodated salt involves a few precautions. The iodine in the salt can be destroyed by prolonged exposure to direct sunlight and moisture. Therefore, store the salt in an airtight container made of plastic, wood, glass or clay, with a well-fitting lid. Make sure you consume iodated salt as early as possible.

If salt is left exposed iodine is lost.



## 19

# What should I do if I cannot find Iodated Salt in my local market?

The Government of India has decided to make iodated salt available in a phased manner all over the country. If your local market does not stock this salt, write to the Civil Supplies Department of your State or UT or to the nearest Salt Commissioner's Office, the address of which is given on the last page of this booklet or to the IDD Cell of Directorate General of Health Services, Government of India.

## 20

# How long will I have to keep using Iodated Salt?

If you live in an iodine-deficient environment, there is no likelihood of the deficiency being corrected at the source, namely, in the soil. On the contrary, the increased degradation of our environment is making the problem worse. Largescale deforestation, among other things, has led to increased flooding and erosion of the [illegible] soil, which

Salt Commissioner of India
17, Shivaji Marg,
Sawai Ram Singh Road,
(Near Diggi House)
Jaipur-302 004.
RAJASTHAN

Dy. Salt Commissioner
11 Block, 11th Floor,
Shastri Bhawan,
Nungambakkam.
Post Box No. 706.
Madras-600 006.
TAMIL NADU.

Dy. Salt Commissioner
Ajanta Commercial Centre
B Block, 4th Floor,
Ashram Road,
Ahmedabad-380 014.
GUJARAT

Dy. Salt Commissioner
Exchange Building
Sprott Road, Ballard Estate,
Post Box No. 1561.
Bombay-400001
MAHARASHTRA

Asst. Salt Commissioner
8 Lindsay Street, 4th Floor,
Calcutta 700 087.
WEST BENGAL

Asst. Salt Commissioner
Salt Department Building
Near Haathi Colony,
Jamnagar-361 001.
GUJARAT

Asst. Salt Commissioner
East Godavri Distt.,
Kakinada-533 003.
ANDHRA PRADESH

Asst. Salt Commissioner
80 George Road,
Tuticorin-628 001.
TAMIL NADU

## Do's

1. Ensure strict quality control measures at iodisation plants.
2. Always pack iodised salt in moisture proof sacks and seal these sacks properly.
3. Always shield iodised salt from moisture, sunlight and high temperature while storing.
4. Make sure salt that has been iodised first is also despatched first.
5. Stamp the date of manufacture, the name of the manufacturer, and the level of iodisation on the salt packets. This must be done because iodised salt should be consumed within a year of iodisation.
6. Whenever you buy salt,insist on iodised salt.

## Don'ts

1. Never use ordinary, unlined jute bags.
2. Never store in the open or in a damp, poorly ventilated godown.
3. Avoid transporting in open trucks or in open railway wagons.
4. Never store iodated salt beyond six months.

आयोडीन नमक

Published by :
The Ministry of Health & Family Welfare, Government of India

INDO-1092/CDN/ENG-HIN/1 50/92/2903-2284/PS/ND

INTERNATIONAL COUNCIL FOR CONTROL OF IODINE DEFICIENCY DISORDERS (ICCIDD)
OFFICE OF THE REGIONAL CO-ORDINATOR, SOUTH ASIA & PACIFIC

ICCIDD

CENTRE FOR COMMUNITY MEDICINE
All India Institute of Medical Sciences, New Delhi-110 029, INDIA
Office: Tel.: 91-11-6863522, Fax: 91-11-6863522
Telex: 31-73042 AIMS-IN Grams: MEDINST

CENTRE FOR COMMUNITY MEDICINE AIIMS

1st September, 1997

Dear friends and partners in IDD elimination,

The month of October is of special significance to all of us Indians. The Father of our Nation - Mahatma Gandhi - was born in this month. We would like to pay him a fitting tribute by dedicating our efforts to eradicating the social and health problems that continue to confront society. This is especially true of a health problem that affects all of us.

Iodine Deficiency Disorders are the single most common cause of mental handicap in the world. An estimated 1.5 billion people are at risk of iodine deficiency worldwide. 655 million people suffer from goitre and 43 million people have brain damage caused by IDD, which was preventable. Based on different studies conducted worldwide, it has been estimated that children living in iodine deficient areas, have 13 IQ points lower, than children living in iodine replete areas. The social and economic loss caused by IDD to any society is immense.

IDD has long been recognised as a major health problem in India. Surveys have shown that IDD is endemic in all states and union territories of the country. Over 20 per cent of Indians, or an estimated 217 million people are vulnerable to Iodine deficiency and its spectrum of disorders, at all stages of development - foetal, neonatal, childhood, adolescence and adulthood. 54 million people have goitre, another 2.2 million have cretinism and 6.5 million have mild neurological disorders. In order to over come IDD, Universal Iodisation of Salt was implemented in India, with the target of Universal Access to Iodised salt by 1995, so that IDD could be eliminated by 2000 AD.

Ensuring legislation to iodize salt was one thing, monitoring its availability and consumption by all was another. Though some surveys were conducted in different places, at different times in the country, no countrywide survey has been attempted so far. It is difficult for an external independent agency to collect this information from all over the country. Only a network of non-governmental organisations can accomplish this nationwide assessment on the availability of iodised salt.

The Centre for Community Medicine (CCM), at the All India Institute of Medical Sciences, has for many years been associated with efforts to sustain elimination of IDD. In fact the department was involved with the famous Kangra Valley Experiment.

This experiment demonstrated that iodine supplementation of salt in the diet, reduced the incidence of IDD. Studies conducted in Delhi and other parts of the country, by CCM, demolished the myth that IDD was prevalent only in the Himalayan and sub-Himalayan regions.

We were also involved in highlighting the impact of maternal iodine deficiency on new born babies. We proved that neonatal chemical hypothyroidism affects a child's intelligence.

Studies conducted among school children in Delhi have established that despite the ban on sale on un-iodised salt, people still continue to consume un-iodized salt. This has underlined the importance of monitoring not only production, but also the sale of iodised salt.

Taking into account the magnitude of this survey, we are now volunteering to carry out the task of monitoring the availability of iodised salt at the national level, with the help of non-governmental organisations. Our previous endeavours with NGO's of selected districts of UP was very successful. This has emboldened us to take this step. The NGOs have been selected on the basis of names suggested to us by the District Commissioner of each district in India. Some names have also been suggested by VHAI & CMAI.

We hope to bring out a joint report on the basis of this study called the Citizens report on the availability of iodised salt in India.

We seek your co-operation in making this venture a success. It will help us raise this issue at the national level, and develop and suggest strategies to eliminate IDD from India.

Please feel free to contact any one of us in this regard:

Thanking you,

Yours sincerely,

cspandav

(Dr. C.S. Pandav)
Additional Professor &
Regional Coordinator, ICCIDD
South Asia & Pacific Region

Anand

(Dr. K. Anand)
Assistant Professor

Saroja

(Ms. S. Narayanan)
Project Officer, ICCIDD

## *WHAT DO WE WANT FROM YOU ?*

1) Collect samples of salt from 10 shops in the area where you are working.

2) If more than one type of salt, (not brand but in terms of packed/loose or powder/big crystals - see Proforma for shops,) take a sample of each.

3) Use the kit provided to test for iodine content of salt.

4) Fill the polythene packet and send them to ICCIDD Lab at Delhi in the pre-paid envelop provided.

5) Fill the details in the form provided.

## *PRE-PAID ENVELOPS*

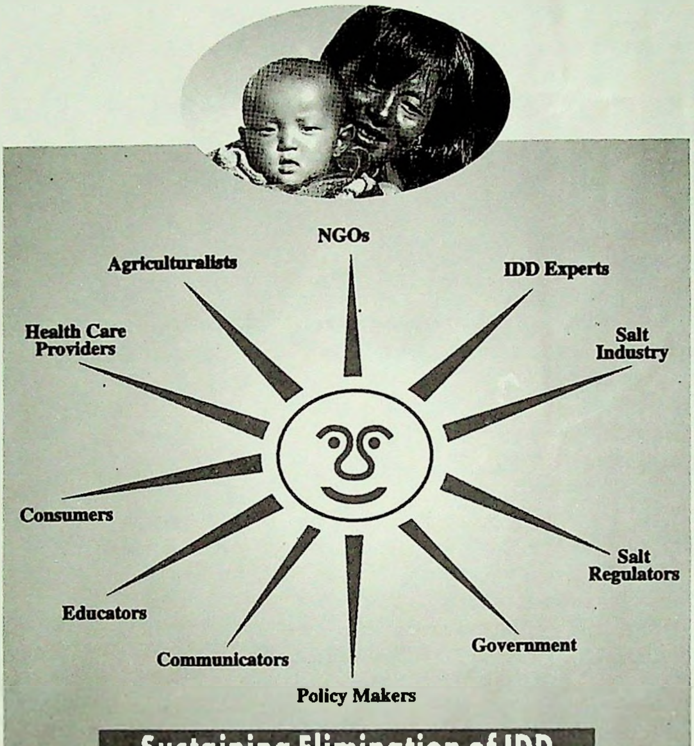
The pre-paid envelop is being provided to you so that the samples can be sent to us conveniently. Do not put more than 4 packet of salt per envelop.

## *HOW TO USE THE KIT ?*

1) Take one tea spoon of salt on a white paper.
2) Add a drop of the test solution on it.
3) Wait for 30 seconds.
4) Read the answer only as Yes / No.
5) It is yes, if the colour of the salt turns violet of any shade. It is no, if there is no change in colour.

## *CHECK LIST*

| | |
|---|---|
| Pre-paid envelops | = 10 |
| Zip lock polythene bag | = 40 bags |
| Spot testing kit | = 1 |
| Proforma | = 10 |




**Sustaining Elimination of IDD**

ICCIDD

# 50 Years of Independence : Month of Mahatma Gandhi's Birthday

## Iodine Content of Salt in Retail Shops

Name of NGO :

Name of Village/Town :

Name of Shop :

District :

State :

How long do you keep the salt (Stock) :

Please Complete this Table - Thanks

| S. No | Type of Salt | Availability (Yes / No) | Label | | | Price / KG (In Rs.) | Iodine Yes / No |
|---|---|---|---|---|---|---|---|
| | | | Yes | Name | Iodised or Not | | |
| 1. | Company Packed | | | | | | |
| | | | | | | | |
| | | | | | | | |
| 2. | Self Packed | | | | | | |
| 3. | Loose Salt : Kept in box / jute bags / other containers | | | | | | |
| 4. | Salt kept open on floor | | | | | | |
| 5. | Salt for animals | | | | | | |

If More than one variety of salt please mention it, Thank you

# स्वतंत्रता के पचास साल : महात्मा गांधी जन्ममास

## दुकान में उपलब्ध नमक में आयोडीन की मात्रा

संस्थान का नाम :

गांव का नाम :

दुकान का नाम :

जिले का नाम :

राज्य :

नमक को कितने दिन रखते हो :

कृप्या इस खाने को पूरा भरे - धन्यवाद ।

| क्रम सं० | नमक की किस्म | आपकी दुकान में उपलब्ध है या नही | नमक का नाम | | | कीमत / कि. ग्रा (रू.) | आयोडीन हां / नही |
|---|---|---|---|---|---|---|---|
| | | | हां | नाम | आयोडीन युक्त है या नही | | |
| 1. | सील बन्द | | | | | | |
| | | | | | | | |
| | | | | | | | |
| 2. | स्वयं पैकिट बंद | | | | | | |
| 3. | खुला नमक : डिब्बे में / बोरी में / अन्य | | | | | | |
| 4. | फर्श पर रखा खुला नमक | | | | | | |
| 5. | जानवरों के लिए नमक | | | | | | |

अगर एक किस्म से ज्यादा प्रकार का नमक है तो कृप्या विवरण दे :

# 50 Years of Independence : Month of Mahatma Gandhi's Birthday

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| | | | | | | | |
| | | | | | | | |
| 2. | Self Packed | | | | | | |
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If More than one variety of salt please mention it, Thank you

# स्वतंत्रता के पचास साल : महात्मा गांधी जन्ममास

## दुकान में उपलब्ध नमक में आयोडीन की मात्रा

संस्थान का नाम :

गांव का नाम :

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जिले का नाम :

राज्य :

नमक को कितने दिन रखते हो :

कृप्या इस खाने को पूरा भरे - धन्यवाद ।

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|---|---|---|---|---|---|---|---|
| | | | हां | नाम | आयोडीन युक्त है या नही | | |
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| | | | | | | | |
| | | | | | | | |
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ORAL REHYDRATION THERAPY • CONTROL OF DIARRHEAL DISEASES • ORT

December 1987
Vol. II, No. 9

# TECHNICAL LITERATURE UPDATE

A MONTHLY REPORT OF CURRENT LITERATURE ON ORT & RELATED HEALTH ISSUES

Technical Writer: ROBERT NORTHRUP, M.D.     Editor: WILLIAM AMT

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Buccimazza, S.; Hill, I.; Kibel, M.; Bowie, M. THE COMPOSITION OF HOME-MADE SUGAR/ELECTROLYTE SOLUTIONS FOR TREATING GASTRO-ENTERITIS. South African Medical Journal, 1986, Vol. 70, 728-730.

Five different instructions for preparing a sugar-salt solution for early home treatment of diarrhea were tested for their effectiveness in communicating to low-income mothers in Cape Town, South Africa, how to mix the solution correctly. The instructions compared use of a cup versus use of a liter container as the volume measure for the water, and pinches versus level teaspoons versus half-level teaspoons versus 5 ml medicine-dispensing spoonfuls as the measuring tools for the salt and sugar. Mothers were asked to prepare solutions according to one of five sets of instructions. The sugar and sodium concentration, the osmolality, and the volume of the measuring devices actually used by the mothers in making the solutions were then determined.

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The results showed that instructions for use of a half-level teaspoon of table salt and eight level teaspoons of cane sugar in one liter of water produced the safest, most accurate solutions. The variation which resulted from use of the cup measure, the level teaspoon of salt, and the pinch of salt was so wide as to produce an unacceptably large percentage of hyper- and hypo-osmolar solutions. The 5 ml dispensing spoon had greater volume than the teaspoons provided by mothers (range of volume of the majority between 2.5 and 4 ml), and led to hyper-osmolar solutions. In the taste test, 16 of 25 mothers identified a sodium concentration of 140 mmol/l or more as tasting similar to their own tears, with nine of the 16 choosing a solution greater than 180 mmol/l. The authors concluded that using taste could lead to the administration of excessively salty solutions and should not be recommended.

[Editorial Comment: This simple, but elegant, study is an excellent example of the kind of study needed by most DDC program managers to make decisions about messages on home therapy. In this environment, the liter measure was more accurate; in another, the cup, glass, or other culturally dependent measure may be more likely to be correct and consistent. That is why such studies are needed in each different cultural setting.

The taste studies disappointed me. I had thought that this very human and homely approach was probab'y useful. This study shows that it is not, that most mothers in this setting did <u>not</u> pick the correct solution. I might point out that, in similar fashion, mothers in certain cultures use home-available solutions to treat diarrhea which have either too much or too little salt and/or sugar.

The sad conclusion must be that indigenous cultural practices are not always appropriate physiologically, and need careful study and, perhaps, modification. RSN]

Green, E. DIARRHEA AND THE SOCIAL MARKETING OF ORAL REHYDRATION SALTS IN BANGLADESH. <u>Soc. Sci. Med.</u>, 1986, Vol. 23, No. 4, 357-366.

A national-level anthropological study of knowledge, attitudes, and practices related to diarrhea was carried out in Bangladesh to provide the basis for an effective program to market ORS there. The study used open-ended questions and probing techniques to obtain a wider range of answers. Four different types of diarrhea, each with a different name, were identified by respondents: cholera-like, bloody, greenish/yellowish diarrhea with mucous, and "simple" diarrhea. Bloody diarrhea was often seen as more dangerous than vomiting diarrhea (cholera). Forty-two percent said diarrhea might usefully purge bad elements from the body, but purgatives do not seem to be used as treatment.

Although most (75%) recognized that diarrhea leads to weakness and/or fatigue, the symptom of a sunken fontanelle was virtually unknown. There was no term commonly used to express the idea of dehydration.

Ninety-two percent of the respondents recognized ORS, and 86% said ORS was used to cure or treat diarrhea; only 16% said ORS overcomes water loss. Fifty-nine percent had used sugar-salt solution, 58% ORS. Some respondents said ORS is too expensive for them.

Seventy-four percent said babies in their families refuse or do not like ORS, but 36% of this group nevertheless forcefeed ORS to their children. Seventy-one percent said ORS is as good or better than pills. Solid foods are restricted during diarrhea by 75% of the respondents. Only 8% said they restrict breastfeeding.

Most respondents seek help from allopathic practitioners, either trained or untrained, if diarrhea is serious. Radio is a source of information about diarrhea for 60% of respondents.

[Editorial Comment: Once again, it is precisely this kind of anthropologically derived marketing study which is needed by every diarrhea control program if its communication efforts are to be successful. RSN]

Ichinose, Y.; Ehara, M.; Watanabe, S.; Shimodori, S.; et al. THE CHARACTERIZATION OF VIBRIO CHOLERAE ISOLATED IN KENYA IN 1983. Journal of Tropical Medicine and Hygiene, 1986, Vol. 89, 269-276.

Of the 245 strains of *Vibrio cholerae* El Tor isolated in Kenya in 1983, 184 were resistant to tetracycline, streptomycin, and ampicillin. All were sensitive to chloramphenicol and nalidixic acid.

[Editorial Comment: With the traditional treatment for cholera being tetracycline, this finding is a problem. Chloramphenicol has dangerous side effects, and nalidixic acid is expensive. Trimethoprim-sulfamethoxazole was not tested and is a potential alternative.

The presence of drug resistance makes the availability of effective rehydration facilities even more important. Even with drug-sensitive cholera, the first priority in preventing death is rehydration. Feeding along with ORS will reduce stool output and duration of cholera, just as use of effective antibiotics will. RSN]

Kumar, V.; Monga, O.; Walia, I. KNOWLEDGE OF COMMUNITY HEALTH VOLUNTEERS REGARDING TREATMENT OF ACUTE DIARRHOEA IN CHILDREN. Journal of Tropical Pediatrics, October 1986, Vol., 32, 214-217.

The knowledge and attitudes about ORT and diarrhea management of community health volunteers in Haryana State, India, was assessed with a questionnaire. Three groups of 30-34 CHVs had been trained differently. A fourth served as the control group.

The results showed that almost none of the CHVs who attended only a broad, three-month basic training course and were not furnished with ORS, could prepare ORS or home solution correctly. In fact, a majority of those CHVs who were given refresher training three times in the year after initial training prepared ORS incorrectly (only about one-third knew how). Those given repeated retraining and furnished with ORS knew ORS preparation and use well, but only one-third could prepare home solution. Ability to remember signs of dehydration increased with refresher training. Despite even the maximum training, half of the CHVs would restrict foods, compared with 80% in the control group, and 29% to 58% of the trained CHVs would restrict breastfeeding, 93% in the control group.

[Editorial Comment: This is exactly the kind of practical, operational study that diarrhea program managers need in order to make informed decisions about how they do training, and how much follow-up is needed. As might be expected, the study shows that a single training course has little long-lasting impact. Follow-up, either through refresher training or monitoring, can make a real difference.

The study also shows that special attention is needed for certain subjects where widespread cultural norms conflict with the desired lesson -- in this case, feeding during diarrhea.

It is interesting to note that Bentley's study in India showed that while mothers often said they restricted feeding, observation of actual practice showed that almost all continued feeding, and all continued breastfeeding during diarrhea. RSN]

Walker-Smith, J. NUTRITIONAL MANAGEMENT OF ACUTE GASTROENTERITIS -- REHYDRATION AND REALIMENATION. Human Nutrition: Applied Nutrition, 1986, Vol. 40A, Suppl. 1, 39-43.

[Editorial Comment: This review, dealing primarily with developed-country patients, nicely emphasizes the importance of high-solute feedings (high-lactose, for example) prior to a diarrhea episode in leading to hypernatremic dehydration when diarrhea occurs. The kidneys are already overloaded and cannot handle the extra burden of loss of hypotonic diarrhea fluid, especially in children younger than six months. If such diarrhea patients then receive a hypertonic rehydration fluid -- as happened during the 1950s in the U.S. with hytren (5% glucose), and with apple juice and Coca Cola today (osmolarity ±600, twice normal osmolarity, and no sodium chloride) -- their kidneys cannot compensate, and they become hypernatremic. WHO-standard ORS formula has been used by Pizzaro in such hypernatremic and dehydrated children with safety and food correction of hypernatremia. We must consider carefully our recommendations to mothers so that we do not push hyper-osmolar fluids (high in sugar, usually) on children with diarrhea.

Walker-Smith goes on to point out that post-diarrhea "lactose intolerance" may be more related to the use of high-solute milks (i.e., iatrogenic) than to a functionally commanding lactose deficiency. This corresponds to experience in developing countries. But his assumption that post-diarrhea problems are due to a difference in allergenicity of milk in the developed versus the developing world, with diagrams blaming this on mucosal IgA deficiency, seems overly imaginative, and no data are cited. His recommendation of cow's milk-free formulas for diarrhea patients in the developing world is quite inappropriate. Breastmilk should take first priority, and other simple starchy foods second priority. Pushing any formula, implying the use of feeding bottles, is not a good idea, in general. These specific types of formulas are so expensive as to make their use by other than the few rich children in developing countries quite out of the question. RSN]

ORAL REHYDRATION THERAPY • CONTROL OF DIARRHEAL DISEASES

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TLU EXTRA

TECHNICAL LITERATURE UPDATE

A MO[illegible] T OF CURRENT LITERATURE ON ORT & RELATED HEALTH ISSUES

Technical Writer: Robert Northrup, M.D. Editor: William Amt

## NEW WHO CDD PROGRAM POSITION ON FLAVORING IN ORAL REHYDRATION SALTS

Until recently, the WHO CDD Program has actively discouraged countries and ministries of health from using flavored preparations of oral rehydration salts (ORS), emphasizing in their interactions with governments the desirability of using preparations with only the four basic ingredients (NaCl, KCl, $NaHCO_3$, and glucose). In addition to the potential for added flavor raising the price, the strongest arguments against the flavored preparations have been the desirability of having a single preparation on the market (to reduce confusion among purchasers as well as health workers), and the possibility that added flavor may lead to children drinking too much of the solution and thereby developing hypernatremia. Previous issues of the TLU have discussed this subject.

Manufacturers of ORS, however, have almost uniformly wanted to add flavoring, based on their own assessment of the flavor of the plain product, and complaints from parents either that they thought it tasted bad, or that their child refused to drink it because of its taste. Many flavored preparations of ORS are already on the market.

In the most recent issue of CDD Update, an occasional publication of the CDD Programme, we see for the fist time some relaxation of the previous position. While continuing to recommend the simplest ORS product, the Programme has laid out clearly the potential advantages of flavoring in increasing acceptability and use of ORS. It has also declared publicly that there is no documented evidence that flavoring will either lead to overconsumption and consequent hypernatremia, or lead to underconsumption. Recognition that the slight additional cost may bring proportionate benefits by leading to greater acceptability and increased use is also clearly stated.

This step opens the door to governments more freely allowing private manufacturers to distribute and sell flavored products, and to reconsidering whether they will promote officially both flavored and unflavored products. While we will all await evidence scheduled to come from studies of the possibility of overconsumption or underconsumption, this gives us the possibility of responding more positively at present to the wishes of consumers and producers of ORS for flavored preparations.

In view of the importance of this development, we quote the complete text of the relevant portion of the CDD Update (No. 2, November 1987):

> *With the aim of making an essential drug available at a low price, WHO and UNICEF have consistently recommended the use of ORS compositions that contain the four basic ingredients needed to yield an effective solution. Many commercially available products, however, contain a flavouring agent, and some a colouring agent.*
>
> *The theoretical advantage of flavoured ORS is greater acceptability (to care providers and children) and consequently increased use. The most important role of ORS is to treat dehydrated diarrhoea cases. In such cases taste has not been found to be a problem (and flavouring is thus irrelevant). In achieving widespread popular use of ORS, however, particularly in the prevention of dehydration and in post-rehydration maintenance therapy, improved taste may be an advantage. These comments could apply equally well to colouring of ORS.*
>
> *The theoretical disadvantage of flavouring or colouring that gives rise to the greatest concern is the risk of overconsumption and consequent hypernatremia; however, there is no documented evidence that this is, in fact, a problem. WHO is supporting a study to investigate this issue. Additional studies would be welcome. It is also possible that flavoured ORS could in certain cases result in underconsumption, as patients requiring large volumes of ORS, particularly adults, may find flavoured ORS unpalatable after ingesting large amounts. Again, this has not been documented.*
>
> *Colouring of ORS has lead (sic) to changes in stool or urine colour and consequent confusion in diagnosis in a few cases.*
>
> *The addition of flavouring and colouring agents adds to the cost of ORS; however, it is possible that it may bring proportionate benefits. Any added substances should be shown not to adversely affect the safety or the stability of the product.*

Dr. K.P. Aravindan

# NATIONAL POLICY FOR UNIVERSAL SALT IODISATION

# A Critique

Kerala Sastra Sahitya Parishad

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Dr. K. P. Aravindan

Kerala Sastra Sahitya Parishad

English □ National Policy for Universal Salt Iodisation. A Critique □ Dr. K. P. Aravindan □ June 1989 □ First Edition □ Published by Kerala Sastra Sahitya Parishad Parishad Bhavan, Trichur-680 002 □ Printed at GEO Printers, Trivandrum □

Cover : Jayachandran

Price : Rupees Three only

KSSP 0408 IE June 1989 2 k LL 6 / H-89

# National Policy For Universal Salt Iodisation : A Critique

The ubiquitous common salt which once was the symbol of our struggle for national liberation will soon be no more. The low cost crystal salt will be replaced by a higher priced, fine, iodised salt coming in sleek bags and carrying brand names made familiar by the electronic and other media. Another item of mass consumption is going to be fully integrated into the advanced capitalist market economy. The changeover will be effected by suitable legislation by the Government of India, buttressed by arguments put forth by a 'neutral, disinterested' scientific establishment. The monopoly sector of the Indian industry will chip in with their might, guided, of course, by the 'noble' pursuit of profit. Naturally, all these will be done in the name of the poor suffering millions, so that questioning it would be made to appear almost blasphemous. The object of this article is to raise exactly a few of such blasphemous questions.

## The Background

Endemic goitre is enlargement of the thyroid gland seen in a significant number of people in a population. This has been described in India from almost the vedic times. *Charakasamhita* and *Susrutasamhita* refer to neck swellings in what are most likely cases of goitre. It is known from the early part of the century that the inhabited valleys of the Himalayan massif is one of the world's largest contiguous areas of goitre prevalence.[1,2,3]

The development of goitre or thyroid enlargement can be due to various factors. Undoubtedly, deficient intake of iodine is the most important of these causes. Iodine is necessary in minute quantities for the thyroid gland to synthesise its hormone thyroxine. This iodine is usually made available through food and water. In areas where iodine is deficient in water and soil, goitre incidence increases. In some other areas substances taken in the food can block the entry of iodine into the hormone. Such substances, called goitrogens, are known to be a cause of endemic goitre either acting alone or in consonance with iodine deficiency.

It has been established beyond doubt that in the Sub-Himalayan belt extending from Kashmir to Assam (figure I) iodine deficiency is the cause of goitre.[1] The water and the food grown in the area is deficient in iodine and the people consume little or no fish and meat, which are rich sources of iodine, due to poverty and unavailability.

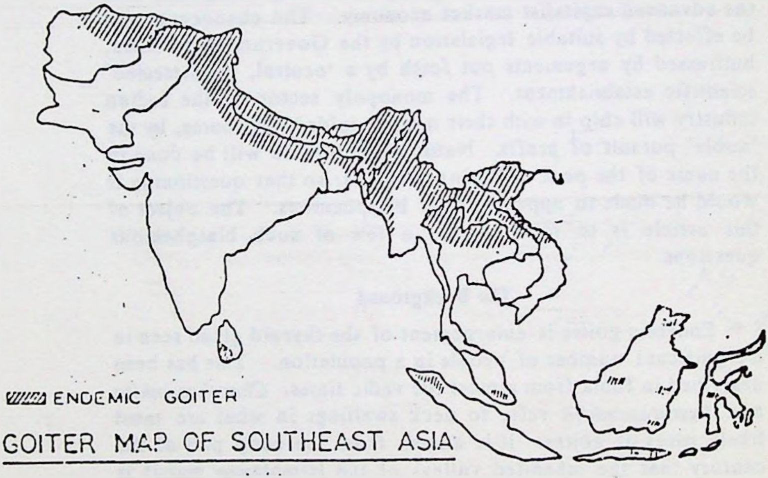


Fig. 1. Endemic goitre in Southeast Asia (Ref. 1)

In such areas of the world various ways have been thought of by which iodine can be supplemented in the diet. The most successful way this can be achieved is by iodising salt used for human and animal consumption. This is done by adding a specific amount of potassium iodide or iodate to the salt at the point of manufacture.

Apart from the cosmetic problem caused by a greatly enlarged thyroid gland, it is also found that in areas of high endemicity of goitre, some children are born with gross mental retardation, deaf-mutism and other physical abnormalities (Cretinism). Prevention of this unfortunate disease is another important aim of salt iodisation.[2]

Recognising the public health problem posed by the Sub-Himalayan endemic goitre, the Government of India initiated the National Goitre Control Programme in 1962. The modus operandi of this scheme was to (i) survey the suspected endemic areas, (ii) supply of iodised salt to the areas, (iii) prohibit the sale of non-iodised salt in those areas and (iv) resurvey after periodic intervals to assess the impact of the programme. The Government set up salt iodisation plants in the public sector in Rajasthan, Gujarat, Assam, West Bengal and Himachal Pradesh. The state owned Hindustan Salts was given the sole monopoly for the production of iodated salt.[3]

Despite these measures, the National Goitre Control Programme languished after a promising start. The "sad story" of its mismanagement was sharply attacked by C. Gopalan, former Director of I. C. M. R.[4] This led to the setting up of a working group by the G. O. I. to review the entire working of the National Goitre Control Programme. It is the acceptance of the suggestions made by the working group that led to the policy of 'Universal Iodisation of common salt'[3].

**Strange Recommendations of the Working Group**

To any discerning observer the causes of the failure of the programme in the endemic areas were obvious. The working group seems to have glossed over these entirely.

1. The public sector units which were entrusted with the production of iodated salt were not able to produce the required quantities. The fact was accepted tamely without going into the reasons. The disinterest and lack of political will on the part of the Government was not seen as the most important factor. This was no doubt influenced by the urgings of the private salt manufacturers. The fact that this is not due to the innate inefficiency so often attributed to the public sector is borne out by the efficient functioning of the untertakings in which the Government is really interested — look at the companies manufacturing condoms for the Government's pet family planning project!

2. The failure of health education campaigns to make the people in the endemic areas aware of the need to consume iodised salt. Such an education campaign relating to their daily life situation would have gone a long way towards the success of the programme. This lack of enthusiasm is again in striking contrast to the missionary zeal of the F. P. propaganda.

3. Iodised salt was not made available in the endemic areas at the same or lower prices as compared to uniodised salt. This led to the smuggling and selling of cheaper non-iodised salt. There was no administrative willingness to check this. In the absence of a proper health campaign, people went in for cheaper salt.

4. Some of the salt sold as iodised was, in fact, not so at all. There were no proper quality control measures to detect this.

5. Transport bottlenecks led further to non-availability in areas where it is most required.

Instead of studying the causes of this failure and giving suggestions for streamlining the existing production and distribution system, the working group seems to have arrived at totally different and strange conclusions. It recommended that the only solution is to go in for universal iodisation. The reasons given were as follows.

1. It was administratively difficult to prevent the entry of non-iodised salt in the goitre endemic areas.

2. The problem of goitre and IDDI was widely prevalent throughout the country and new endemic areas were frequently being identified.

3. The use of iodised salt by normal healthy individuals was not a health hazard.[3]

Increased production is sought to be achieved by throwing open the production of iodised salt to the private sector. As regards distribution and quality control, despite platitudes, the underlying hope seems to be that the market forces will take care of everthing. As regards the second and third reasons, they seem to be put in as afterthoughts based on 'scientific evidence' so conveniently supplied.

The working group recommendations and the Government policy announced shortly thereafter are not based on a realistic assessment of the causes of earlier failure. To quote Gopalan, a supporter of the policy, "It will be a serious and naive miscalculation to expect that by just extending the salt iodation programme to cover the entire country, implementation will be simplified and current deficiencies will be automatically overcome."[5]

## Socio Economic Cost of Universal Iodisation

*Fate of small manufacturers*

About 9 million tons of salt is produced in India annually. Except for negligible amounts, it is mainly from sea water in the states of Gujarat, Tamilnadu, Maharashtra and Andhra Pradesh. About 10,000 manufacturers are involved in the production. 50% of the salt used for human consumption is produced by small scale manufacturers with fields less than 40 hectares in size.[6]

The process of iodisation can be done in different ways. Spray mixing technology is the one favoured by the Government and the UNICEF. Moreover, only this technology can iodate salt in large quantities (5 tonnes per hour) and ensure uniform mixing of salt. The Government of india has decided to supply potassium iodate free of cost to the manufacturers. But the experience so far has been that the delivery is not prompt.[7]

The real problem for the small manufacturer is that an initial capital investment of 3–5 lakhs of rupees is needed for one spray mixing unit, which most of them are in no position to raise. Moreover, for those with smaller fields (a vast majority) this technology is not cost effective. A further snag is that the manufacturers have to set up and maintain a quality control laboratory which adds to the initial and recurring expenditure. Newer regulations about packaging will also be disadvantageous to the small scale sector.

Adding to their woes is the competitive selling of iodised salt under different brand names. In the resultant free market warfare it will be a great wonder if the small scale sector survives. In all likelihood the monopoly houses like the Tatas who have now entered this field will make full use of the new policy to drive the small manufacturers out of business with their shrill advertising and aggressive marketing.

*Cost to the consumer*

Common salt sells in most areas of the country at a price of approximately 50 ps per kg. The process of iodisation which involves extra expenditure tends to increase the price despite the subsidies. Apart from the capital costs involved, there is a definite increase in the continuous operating costs. It is claimed that the minimum operating costs work out at about 11 paise per kilogram, which is most probably an under-estimate. Of this, only about 2 paise per kg is the Government subsidy paid in the form of free supply of Potassium Iodate.

In fact, the increase in prices would be out of proportion to the actual increase in expenses incurred. This is already seen in the market where iodised salt sells for prices ranging from Rs. 1.50 to Rs. 3 per kg. Only extreme naivete would permit the hope that this will come down in future. The very success of the current strategy depends on the co-operation of the private sector and it would be unrealistic to hope that they would be willing to forgo the current levels of profit in the industry. As for the capability of the Government to force the private sector to bring down the prices, past experience in the different areas of industry should be an eloquent guide.

It is claimed that the costs of Rs. 1.5/kg and above is only that of refined iodated salt, and that iodated crystal salt would sell cheaper as it already in the endemic areas. But the whole point is that the new policy with emphasis on the private sector and reliance of the market will help the big manufacturers using the continuous spray mixing technology and sophisticated packaging to prevail over the others. It is feared that the crystal salt manufacturers (mostly small manufacturers and the public sector) will be pushed out of production. There would be an inexorable shift towards refined salt aided by the regulations and policies followed. UNICEF, the active partner of the GOI in the implementation of the programme says in a document, "A lot of the salt in India is in crystal form.

Historically consumers have bought only crystal salt. It is proposed that the common salt will be crushed before iodation. This would be achieved in a phased manner and consumer education will be undertaken to change consumer preferences."[6]

The final result would be that instead of salt now being sold at 50 paise/kg, it would cost a minimum of Rs. 1.5/kg. This would cost the consumer a minimum of Rs. 500 crores annually. In other words, the Government would take Rs. 500 crores from the poor citizens in whose name the policy is being pushed through and pass it on to the monopoly sector of Indian private industry.

*Cost to the Government*

The Government has comitted an estimated Rs. 210 million for the programme in the 7th plan. A further Rs. 125 million is the projected cost for the 8th plan period excluding the recurrent costs of the staff, subsidy and other inputs. Furthermore, all the iodine required for the programme would have to be imported and paid for in foreign exchange. It is only natural to ask whether this kind of expenditure would not have been more worthwhile if it was spent to make the already existing goitre control programme in the endemic areas a success.

*Fate of the endemic areas*

If the proposed increase in iodised salt manufacture does not keep up with the schedule, there is the real danger that the supply to endemic areas will worsen. Previously, the flow of iodised salt was from the production centres to the endemic areas. Now with the policy of universal iodisation, it would be easier and more profitable for the private manufacturers to sell the higher priced salt in the metropolitan and well developed markets. We may see a situation where people who really need the product do not get it, while those who do not need it get a surfeit of the same. This situation already exists for several products like drugs.

Perhaps, anticipating this, it has been recommended that in the interim period (ie. till iodised salt manufacture attains necessary levels) the people in the endemic area be covered by injections of iodised oil.[6] But it has been pointed out that this would be prohibitively costly besides requiring large imports. Moreover, it is strange to suggest that "areas which are 'inaccessible' to common salt would be easily accessible to periodic massive injection programmes![5]

**The 'Scientific' Backbone of Universal Iodisation**

The universal iodisation policy, if pushed through as it is, will be done at tremendous social and economic cost. But the bitter pill would have to be swallowed willingly, had the scientific argument in its favour been so strong as to make it imperative. Faced with any criticism of their policy, the authorities would take cover behind the shield of 'learned scientific opinion'. It is worthwhile to examine how foolproof the scientific arguments in support of universal iodisation really are.

Virtually all the studies forming the basis of the new policy have been done by a handful of scientists—mostly in the All India Institute of Medical Sciences. The claim is that they have uncovered several new facts which challenge the conventional wisdom.

*The Conventional Wisdom*

The conventional wisdom till the late seventies has been that a programme for the prevention of endemic goitre can be justified only in terms of health. If endemic goitre were merely a cosmetic problem there could be little justification for government action. However large nodular thyroids may cause obstructive symptoms and may be subject to malignant changes. In addition, when endemic goitre is severe, endemic cretinism is also found.

Leading from this question was posed as to what level of endemic goitre or endemic cretinism justifies a prophylactic programme. Obviously the criteria accepted would vary according to the socio-economic situation of a country. Methods for grading goitres in surveys were developed whereby all goitres were graded on a scale from 0 to 4.[10] In general, it was suggested that a 5% incidence of Grade I goitre in pre-or peri-adolescent school children or a 30% incidence of goitre in the general population would certainly warrant some action; the presence in the populalion of 1% persons who could be classified as cretins would demand early and urgent action.[9]

*Chullenge of 'new evidence'*

The bedrock of the new policy is the purported new evidence unearthed by studies done in India. The main line of argument is more or less as follows.

1. Previously it was thought that an adaptively enlarged thyroid gland compensated for iodine deficiency by stretching its capacity to put out enough thyroxine to meet bodily needs, i.e., the patients are 'euthyroid' (thyroid function normal). It is now claimed that more than half the goitrous persons in the severely endemic areas were 'hypothyroid' or that they had thyroxine deficiency.[11]

2. Sub-cretinous brain damage occurs in endemic populations in addition to overt cretinism.[12] The argument is that even in areas with no increase in the rate of cretinism, children have subnormal intelligence and this can be detected by IQ tests. The problem of mental retardation may be much more extensive than was inferred originally from the observation that only less than one percent of children in goitre endemic areas suffer from cretinism. Recent studies reveal that 15% of children could be suffering from varying degrees on mental retardation.[3]

3. The risk for such subnormal intelligence can be assessed by screening new borns for thyroxine deficiency. By such methods, in the severe endemic areas, as much as one in six new borne is found to be thyroxine deficient at birth.

4. Newer endemic areas in India are being found in surveys and the cause for endemic goitre in these areas is also iodine deficiency.[11]

5. Prophylaxis of endemic goitre is best done by iodising salt. Excess intake of iodine will not be a problem given the current levels of intake in any part of India.[11]

Each thread in this line of argument needs to be examined in detail.

*1. The claim of hypothyroidism in Himalayan endemic goitre*

The most quoted study in support of this claim is one by Kochupillai, *et al.*, published in 1973.[13] This article is cited often and with an air of finality to the claim that as much as 60% of the goitrous individuals are decompensated and subthyroid.[14, 15]

In reality all that the study shows is that the mean levels of TSH hormone is increased in the 26 goitrous subjects studied when compared to controls in England. In fact, the mean thyroxine (T4) levels were higher (significantly so in grade I goitres) when compared to the same controls. In a classical example of double talk, the authors try to dismiss this by saying that it is possibly due to the fact that the controls were from England! True, the authors find that the effective thyroxine available (represented by the values of ETR) is slightly reduced. But the most important point actually seen from the results but only cursorily discussed is the fact that the second type of thyroid hormone called T3 is significantly elevated in the subjects when compared to the controls.

Now, what happens is that the thyroid enlarges in response to the increased secretion of the pituitary hormone TSH and makes more economical use of the iodine available by preferential secretion of triiodothyroxine (T3) which is metabolically more active than thyroxine but contains less iodine (three atoms per molecule as compared to four for thyroxine).[16,17] In these persons the normal function of thyroid is thus maintained.

There is a tendency among some endocrinologists to use the term 'subclinical hypothyroidism' in subjects with normal thyroxine and elevated T. S. H. But this is apparently a misnomer. To quote an eminent endocrinologist, "I question the wisdom of referring to patients with normal circulating thyroid hormone, but elevated serum TSH values as suffering from 'subclinical hypothyroidism'. Hypothyroidism to my mind is a state in which there is inadequate supply of thyroid hormone to the tissues ..I would prefer the term inadequate thyroid reserve in analogy to other endocrine axis."[18]

The misnomer becomes positively misleading when used in the lay press to whip up support for a policy as Kochupillai has done.[11,19]

Some other attempts to present the above quoted study as something of a landmark, again reveals a misleading propagandist streak out of place in a scientific article. For example, it is said of the 1973 study, "this was indeed disturbing information and lead to an editorial comment in *Lancet* about 'Theory and Practice of Endemic goitre."[14] A close reading of the said *Lancet* editorial[16] finds the work mentioned among many others. It was certainly not the sole inspiration, nor was the main theme of the editorial the same.

*2. The case for subclinical cretinism*

In the mountainous terrain of the Himalayas there are pockets where endemic cretinism is seen in 1–4% of the population. Even higher figures are reported from parts of Nepal.[1] But elsewhere in the sub-Himalayan endemic areas the incidence is uniformly below 1%.[3] In the supposedly new endemic areas being uncovered, endemic creticism is not seen at all. But suppose iodine deficiency produces milder forms of mental retardation (the so-called "subclinical cretinism" a la sub-clinical hypothyroidism that we have just examined). It then becomes a powerful and emotive argument for ramming down the new policy (the unseen drain of brain power of our future generations, etc.). So sub-clinical cretinism enters into the vocabulary and if it did not exist, it had to be invented.

The methodology adopted for proving the new hypothesis involves development and intelligence testing. This approach is highly controversial and has been so riddled with *a priori* assumptions, conscious fraud and politics, that its very value and scientific objectivity has been seriously questioned.[20,21]

In one such study, exactly 26 children of goitrous mothers are compared with 20 controls by using the Gessel development score.[22] It is then concluded that the development quotient and language development are lower in children of goitrous mothers. The mean DQ for the controls is 98.4 and that for others is 94.4. Using a convenient statistical test (t-test) this has been shown to be a significant difference and profound conclusions drawn.

Apart from the conscious fraud resorted to by the likes of the great Cyril Burt, which put mental testing into much disrepute,[23] there are unconscious and theoretical errors which nullify its scientific value. One such is 'reification', ie., the belief that anything given a name (like intelligence) is a thing which can be measured on a metric scale, like height or weight and can further be used for comparing people. The fault in logic in the case of intelligence and developmental tests is clear. The fact that it is possible to devise tests on which individuals score arbitrary points does not mean that the quality being measured by the test is really metric. The illusion is provided by the scale. The ordinal scale is ane arbitrary one and most psychometric tests measure ordinals of this sort. A person with an I.Q of 100 is not twice as intelligent as one with an I.Q of 50.[24] Thus the statistical tests used to compare small differences in scores are inappropriate.

A second criticism often levelled against these tests is that strong *a priori* assumptions alter the result even in the absence of a fraud. The tests do not represent the application of a neutral instrument, a test, by an objective tester, to a testee whose performance is being measured. Rather, the results of a test are themselves the products of a three way interaction between the tester, the test and the testee. The tester's expectations of the testee's performance may itself modify that performance.[25] It is seen that black children score better on IQ tests administered by a black (or even by a computer!) than by a white.[26] This tester bias has led to such monumental errors as classifying the blacks and Asians as less intelligent than whites, women as less intelligent than men, and so on.[24]

Another important source for error is the socio-cultural bias of the tests themselves. In a country like India no single test may be appropriate for all the regions. Yet using such a test battery children in Gonda have been branded less intelligent than those from the average Indian village.[27] This is a slipshod work, to say the least. No controls seem to have been tested at all. Instead, the 'normal' values provided by the tests' designers have been taken. Performance in intelligence tests especially for those who score between 50 and 75 are strongly influenced by factors like material deprivation, poor educational facilities, family instability and lack of mnetal stimulation.[28] Yet we find here supposedly serious scientists testing children from one of the poorest regions of India without even bothering to set up a control and branding them as subnormal. And to add to the original errors they unquestioningly attribute low scores to iodine deficiency without caring to look for other socio economic variables which could have given the same result.

The claim for sub-cretinous mental retardation is not supported by hard evidence. If indeed it is present in such high proportions, it is indeed strange that it is not accompanied by a concomitant increase in clinical cretinism. The studies done by 'convinced' scientists using faulty and careless methods seem more like propaganda for their pet theme rather than real science.

As of now, the following comment by Clements in 1960 seems to be still valid. "Mental deficiency without the other stigmata of cretinism has sometimes been considered to be a sequel of endemic goitre. Most of those who have made this claim have not had close association with endemic cretinism.... Extensive investigaiions of mental defectives in non-goitrous areas have failed to show any connection between thyroid function and mental deficiency. There seems to be no justification for the statement that one of the sequels of endemic goitre in the progeny is uncomplicated mental dificiency.[35]

*Neonatal chemical hypothyroidism*

Proceeding from the assumption that milder forms of mental retardation due to iodine deficiency exists, neonatal screening for thyroid status was organised in selected areas to detect those at risk.[15,27] The indigenous development of effective technology to accomplish this was a commendable effort. But the conclusions drawn from the studies are open to question.

In this study, the cord blood of newborns from the severely endemic areas were examined for T4 and TSH and compared with blood controls from Delhi and Kerala. Using standard criteria, it was found that 7.5% in Gonda and 13.3% in Deoria were hypothyroid, while there was no significant neonatal chemical hypothyroidism in Delhi or Kerala.[27]

It is known that in iodine deficient areas, some children may be born with what is called 'transient neonatal hypothyroidism'. This abnormality is characterised by low serum T4 and high TSH concentrations and spontaneously corrects itself over five to six weeks.[29] In Europe, transient neonatal hypothyroidism has been related to iodine deficiency, since the incidence seems higher in regions of endemic goitre.[30,31] In one series of Belgian newborns, the prevalence of transient hypothyroidism was 12%.[29] Most cases occurred in premature infants.[32] The prevalence was 26% in infants under 32 weeks and about 5% in term infants. Significant levels of transient neonatal hypothyroidism has been reported from Sicily.[33]

In the studies quoted from India no attempts have been made to note the proportion of those with transient hypothyroidism. There is further no attempt even to quantize the proportion of premature infants Two of the articles published in 1984 are clear examples of evasion of the issue.[14,15] Transient hypothyroidism is not even mentioned in the discussion. It is difficult to believe that the authors were unaware of the condition which has been described as early as 1978. However, in one of the articles[15] the book containing a discussion on the subject is quoted in the bibliography in another context.[30] This is an example of the kind of intellectual dishonesty that is seen in much of the work on iodine deficiency goitre in India.

The problem of transient hypothyroidism is acknowledged in the discussion in a later paper by the same authors [27] (probably inserted after peer review). In it they admit that it could be important in iodine deficient areas but that they did not look for it because they considered it unethical to follow up these babies without treatment. Again, it is unlikely that they were unaware of the studies in which the babies were given T3 and followed up. In transient hypothyroidism the T4 gradually rises under such conditions in a matter of weeks, whereas in permanent hypothyroidism it does not.[30] They could have easily tried this in at least a subset of these cases, instead of starting them on thyroxine.

Transient hypothyroidism should have been specifically looked for especially in areas like Gonda and Deoria of eastern UP where a higher proportion of birth complications and prematurity is likely among the hospital deliveries. In the control areas of Delhi and Kerala this proportion would be much less, because even most of the normal deliveries there take place in hospitals.

Further, it is not a good policy to put babies with transient hypothyroidism on prolonged thyroxine treatment because of the danger of neonatal hyperthyroidism.[34] There is also some evidence that in neonatal hypothyroxinemia (low T4, high TSH) found in iodine deficiency environments, compensatory increase in T3 is encountered and the babies are compensated.[31]

Undoubtedly, more studies need to be done in this area before firm conclusions and drawn. But one thing which has to de noted even at this juncture is that the control areas, among which Delhi has been claimed to be a new endemic area, are remarkably free from neonatal hypothyroidism, whether transient or otherwise.

*The new endemic areas*

Starting from the fifties and till the seventies, the figures quoted for goitre incidence in India were 40 million people exposed, with 9 million having goitre.[1]. Then in the eighties, almost simultaneously with the beginnings of the new policy, we see a quantum jump in the estimates. The newer estimates have the exposed population at 120 million with goitrous population of 40 million.[36] Even higher figures of 300 million exposed and 60 million goitrous are sometimes bandied about.[37]

There is reason to believe that the new figures are part of a campaign based on gross exaggeration. It is generaly part of an effort to impress the decision makers—political and bureaucratic—and to gain public acceptance for the new policy. It is based primarily on the surveys conducted in different parts of the country followed by blind extrapolation of data using faulty mathematical models.

It is now claimed that out of 132 districts studied, 122 provided evidence of iodine deficiency goitre. But there is no indication that these 132 districts or the areas surveyed were randomly selected. On the contrary, there is reason to believe that these areas were selected because they were suspected to be endemic for iodine deficiency. Extrapolation from these to arrive at total figures would be highly fallacious. It has indeed been claimed that the actual figures for the number of IDD in South-East Asia (which includes India) have probably been overestimated by a multiplicatory factor somewhere between 3 and 6 due to the bias in the mathematical models used.[38a]

Moreover the lay public including the decision makers are misled in another more subtle way. They are told in an article that there are 40 million goitrous people, often accomanied by a photograph of a person with a large neck swelling. The overall impression sought to be conveyed is that there are 40 million such people in the country. As a matter of fact the vast majority of the supposed goitrous people have thyroids which cannot even be seen. Even considering the figure of 40 million to be true, calculations made from the rates of various grades of goitre in the different surveys[38-41] show that the visible goitres will not exceed 4 million. The clinically significant cases causing cosmetic problems will not exceed 0.6 million. If there is a four fold overestimation in these figures, the actual figures would be: total goitrous 10 million, visible goitres 1 million and those producing clinical problems 0.15 million.

These projections are made on the assumption that the percentages of goitrous people obtained in the different surveys are true. In reality, the surveys are liable to considerable bias and variation. It has been mentioned that the large majority of goitres detected in such surveys are not visible but palpable only. Any thyroid thought to be enlarged on palpation (a swelling as big as the terminal phalanx of the subject's thumb) is taken as a grade I goitre.[42] This is highly subjective. When the surveyors are convinced of a high prevalence in an area, this leads to unconscious inflation of the percentages. Palpable and visible goitres can be overestimated in individuals with thin necks or poorly developed sterno-mastoid muscles.[9] This is another source of error in a poorly nourished population like ours.

In the last few years one thrust of argument has been that endemic goitre is no longer a problem of the sub-Himalayan region alone and that it is widely prevalent in other parts of India also. Surveys purporting to back this claim are few in number and subject to the same drawbacks mentioned above. The chance of error is greater because in almost all these surveys the results indicate only mild or moderate endemicity (prevalence below 50%.. The fact that such studies are limited to few isolated

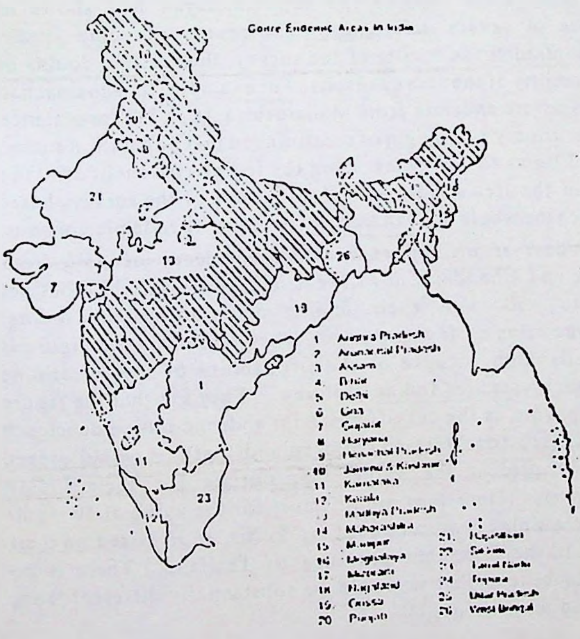

Fig. 2. Goitre endemic areas in India (Ref. 3)

pockets has not prevented fantastic clamis being made. Even the maps have been redrawn to show the new found widespread prevalence of endemic goitre in India (figure 2). These maps are patently dishonest. For example, few isolated pockets in Maharashtra have been surveyed. This has led to the whole state to be shaded and shown as endemic goitrous.

One way of checking the veracity of these survey results is by reference to exacting biological data like that of iodine excretion in urine. Urinary excretion of iodine as a proportion of the excretion of creatinine (iodine/gm of creatinine) when properly done, is a good measure of iodine intake.[42,46] Mean values of less than 50 $\mu$gms/gm of creatinine in a population is indicative of moderate iodine deficiency. Values less than 25 $\mu$gms indicate severe deficiency. This can be tested on casual urine samples and is thus a relatively easy procedure.[42] Yet very few such studies are available from India. The occasional study from areas outside the sub-Himalayan belt shows no evidence of severe deficiency. The results of some studies flatly contradict the results of the survey, thus casting doubts on the reliability of the survey results. For example, Krishnamachari reports severe endemia from Maharashtra, ie., a 52% prevalence. But the urinary iodine/gm of creatinine in that population ranges from 52 $\mu$gms to 141 $\mu$gms. Even the iodine content of drinking water in the area is normal. Yet it is one of the surveys based on which the whole of Maharashtra is shown as endemic goitrous!

Pandav, *et. al.* report a goitre incidence of 55% from Kalkaji and Chandni Chowk areas of Delhi. But this does not correlate well with their finding of mean urinary iodine/creatinine value of 48 $\mu$gm/gm.[40] They argue that this figure is artificially high because of the probability of low creatinine excretion by smaller Indian children. They say that the figure of 50 $\mu$gm/gm as the cut off point for endemic iodine deficiency was proposed for Western children and that this would exceed by 20-30 percent the values appropriate for their Indian counterparts. Here they are in error, for the value of 50 $\mu$gm/gm of creatinine was proposed by Follis, *et al.* based on their findings in the Songkhla province of Thailand. There is no reason to believe that it would be substantially different from the Indian mean values.[48]

There is, however, need to standardise the iodine excretion values in the Indian population for getting comparative data. Differential values for boys and girls may be calculated depending upon their body weight.[49] It has been suggested that measurement of iodine concentration alone in urine is sufficient especially for monitoring control programmes.[42] Whatever it is, iodine deficiency is best monitored and graded by measurement of urinary iodine excretion. Very little of such work has been done in India especially outside the Himalayan belt. No attempts have been made to standardise the values. Wherever goitre really exists significantly and iodine excretion does not reflect the degree of deficiency to account for it, goitrogens have to be looked for. Such diverse things as contamination of water by sewage, organochlorine pesticides, and thiocyanate in tubers are blamed in this context.[42,50] Studies along these lines from India are singularly marked by their absence. There is reason to believe that blind extension of the studies done in the sub-Himalayan endemic to the rest of India may prove counterproductive in the long run.

*The question of safety*

The most hotly debated issue in the new policy concerns the safety of iodine prophylaxis. Two extreme views are generally held. On the one hand, it is held that iodation of salt can produce as many problems as it solves and should not be resorted to at all. The supporters of the policy, on the other hand, dismiss out of hand any reports regarding the complications. Pandav, *et al.*, mention allergic reactions to iodine, iodine induced hyperthyroidism, iodism and iodide goitre as the generally reported complications. They then proceed to demolish the claim for allergic reactions without discussing the others at all.[51] Kochupillai in an article claims that upto 400$\mu$ gms intake of iodine is not only safe but salubrious.[11] As with most extreme polemical views, the truth resides somewhere in between.

It is absolutely true that allergic reactions to iodine and iodism occur due to administration of pharmacologic doses of iodine and is absent in the usual prophylactic programmes. But the following complications need to be given serious thought: a) Iodide goitre b) Iodine induced thyrotoxicosis c) Sequelae of possible increase in salt intake.

*a) Iodide goitre*

It is well known that pharmacological excess of iodide can produce goitre.[52] Extremely high intakes of iodide can produce endemic goitre as seen in the Hokkaido coast of Japan where it is due to high intake of the seaweed 'Kombu' in soup.[53] But can it also occur as the result of a prophylactic programme? The answer seems to be a qualified 'yes'. It appears that milder forms of endemic goitre can be a result of prophylaxis with iodised salt. A survey conducted in four areas of U. S. in 7785 children showed an overall goitre prevalence of 6.8%. In Michigan state the prevalence was 9.8%. These endemic levels are seen many decades after the introduction of the salt iodisation programme. In all these areas iodine intake was more than adequate with a mean urinary iodine excretion of 452 $\mu$gm/gm of creatinine. More interestingly it was found that children with goitre and areas with high goitre prevalence tended to have higher rather than lower iodine excretion.[54] A ten-state nutrition survey of 35,999 people in the US similarly found a higher prevalence of goitre among persons excreting high levels of iodine.[55] The same study found an overal prevalence of 3.1% with a high of 7-2% in Calilfornia.

It can however be argued that the overall incidence of goitre in the U. S. was much higher prior to salt iodisation. While this is no doubt true of the US, it is by no means the rule. For example, there are reports that in Iran and Iraq the incidence of goitre among school children increased after prophylactic use of iodide.[56] It is worth noting that such iodide goitres are mainly reported from US and countries which have followed the US in using high levels of iodide in their salt iodisation programmes.

*b) Iodine induced thyrotoxicosis*

Mild iodide goitre produced by salt iodisation programmes, if and when it occurs, is only a minor public health problem. But thyrotoxicosis, ie, disease due to hyperfunctioning of the thyroid gland is much more serious and cannot be dismissed lightly.

Iodine induced hyperthyroidism, the so-called Jodbasedow effect has been the subject of many reports since the beginning of this century. Early reports noted the precipitation of hyperthyroidism in goitrous patients who were administered large doses of iodine. Iodisation of salt in parts of the U.S. in the 1920s seems to have been followed by a temporary increase in toxic nodular goitre (one form of hyperthyroidism). While the earlier reports were all in those receiving high doses of iodine, it was convincingly shown that physiological doses can also provoke toxic goitre. This was done in a study from Tasmania where a prophylactic programme based on iodation of bread was initiated in 1966.[57] The incidence of thyrotoxicosis in Tasmania showed a steep rise in 1966 and this higher incidence was maintained in 1967 and 1968. The increase was evident after iodation of bread was begun.

In defence of iodation programmes, it is, however, pointed out that the outbreak of thyrotoxicosis in Tasmania occurred predominantly in old people with longstanding nodular goitres. It is also known that the iodation of bread was effective in bringing down the levels of goitre in the community[58] so that such forms of thyrotoxicosis disappeared along with endemic goitre from the region eventually.

This argument is reasonable to a certain limit. In an area where there are cases of endemic cretinism a few cases of thyrotoxicosis may seem a small price to pay for getting rid of a graver problem. But what about areas of moderate or mild deficiency where endemic cretinism is not seen at all?

It has also been stated that iodine induced hyperthyroidism is not seen in the Indian endemic after initiation of prophylaxis. This is assumed to be due to the younger age structure of the population. But this claim cannot be accepted blindly. Has the surveillance for thyrotoxicosis been conducted at all? Who detects the random cases of toxic goitre occurring in far flung backward areas?

Thyrotoxicosis occurring as a temporary phenomenon in certain individuals in a goitrous population may be acceptable, provided the prophylaxis that induced it finally gets rid of it.

This was the comfortable assumption till recently. But what about the non-endemic non-goitrous areas? Can there be an increase in thyrotoxicosis in such a population as well? If so it would be a definite point against introduction of iodistation of salt in the non-endemic areas.

Recent studies in England show that the peak of onset of thyrotoxicosis occurs in the winter months.[59] This has been shown to correlate with winter peak in milk iodide concentrations which in turn correalates with the urinary iodine excretion.[60] Milk provides about half the adult iodine intake in Britain in winter. The higher content of iodide in milk in winter is because the cattle are fed solely on cattle feed enriched with iodine and there is no grazing during the period. The urinary iodine excretions are not (particularly high, with a median of 106 $\mu$gm/gm of creatinine. The study expresses concern that an excess of iodine may be harmful to some individuals and asks whether an alteration of iodine levels in cattle feed should be considered.[60]

The whole question of levels of iodisation is also likely to be reopened by such findings. High levels of iodisation as practised in the USA and sought to be implemented in India may not be so salubrious after all.

*e) The possibility of increased salt intake*

Problems like hypertension can be precipitated by increase in the salt intake. In many Western nations the salt consumption is coming down as a result of this awareness. In India, however, the way iodised salt is sought to be popularised raises genuine fears whether it will not lead to an increase in salt.consumption.

Iodised salt is presented almost as a restorative tonic with wondrous powers. Companies advertise freely claiming that anything from dullness to squint is due to iodine deficiency and that iodised salt is the cure for it, A private company has recently begun an advertising campaign presenting iodised salt as a "healthy food". There is no medical ethical justification for this type of action.[42] Even the Government is made to join in this unethical, unscientific marketing blitz. A comic book shows a boy performing badly in school and dropping catches in cricket. After consuming iodised salt he is transformed into a brilliant student and a cricketing hero. After reading such stuff how many mothers will be able to resist adding that little extra salt to their children's food? The most unfortunate bit is that the said publication is by the Health and Family Welfare deparment of the GOI.[61]

### Towards an Alternative Strategy

The present strategy of universal iodisation is one in which the costs are borne by the consumers and the benefits accrue to the monopolies. The real costs are likely to be higher than envisaged. The costs presently calculated do not take into account the recurring expenditure for maintaining a vast network for quality control and underestimates the cost for several items like import of iodine. Further more, the programme is not likely to succeed because the focus has shifted from the areas of severe endemicity. The whole programme is wasteful of resources and unmindful of priorities facing the nation. There is no appreciation for the opportunity cost of iodisation ie., what other programmes with possible impacts on health, such as immunisation or provision of safe drinking water, could achieve with the same money. The scientific data presented in support of the policy is open to question. Clearly an alternative strategy is called for.

Scientists are often trapped in the quagmire of their own reductionist thinking. This leads them to propose simple 'technological fixes' for problems of complex socio-economic origin. The failure of National Nutrition Programme to solve the problem of malnutrition and of National Blindness Eradication Programme to solve the problem of Vitamin A deficiency should have been eloquent pointers. But no lessons seem to have been learnt. Waiting in the wings of future technological fixes are fortification of salt with iron for anemia and a host of other similar reductionist solutions.

Endemic goitre too is a problem with socio-economic, developmental and ecological causes. These have to be understood properly and solved sincerely. Iodine deficiency of soil is related to flooding, deforestation and soil degradation possibly related to the newer agricultural technologies. A programme to combat iodine deficiency should essentially contain flood control measures, checking deforestation, soil improvement, proper use of pesticides and fertilisers and general eco-restoration. These measures will also help the people in more ways than simply reducing the incidence of goitre.

It is also know that lack of food exchanges are important in the causation of severe endemic goitre and endemic cretinism. This is also a question of development. It has been noted in Mexico that the simple measure of building a road in an inaccessible area resulted in more of food exchanges and disappearance of endemic cretinism. Development and ecology are thus the keystones of a permanent solution to the problem of IDD.

This is not to say that a salt iodation programme has no role. In the severely endemic areas one cannot wait for the general development to occur first. The birth of babies with endemic cretinism is a tragic waste of human resources. In fact this is the problem that needs to be tackled most urgently. Areas of severe and moderate deficiency (which occurs in the sub-Himalayan belt) can be tackled best by a programme limited to those areas. In fact, focus should not be allowed to shift from these areas by the imperatives of the free market economy.

This calls for revival and strengthening of the old National Goitre Control Programme. The anomalies discussed earlier need to be corrected and efficient implementation ensured. Increased production of iodised salt throught the public sector, vigorous quality control along with proper administrative measures to check entry of iodised salt and a proper public health education campaign in those areas should be the corner-stones of such a programme. Subsidy may be given at the level of the retailer or the consumer to bring the price of iodised salt at par with that of ordinary salt. In the most severely affected pockets with that high rates of endemic cretinism, provision of iodised oil to expectant mothers could be considered. This can be done through the PHCs and can be integrated with the maternal and child health programmes.

Further studies to assess the problem in different parts of the country accurately are needed. Such studies should be based on the incidence of endemic cretinism and on urinary iodine excretion parameters. The problem of goitrogens in natural foods and in synthetic chemicals should also be subject of study.

The problem of IDD in India offers no easy solutions. Rather than instant bravado and shotgun solutions, a mature and realistic assessment of the whole problem is what is required. A national debate involving scientists, social workers, economists and politicians is called for.

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## ACT NOW !!!

## PARTICIPATE IN POLICY DECISION MAKING

**********

*The Ministry of Health (GOI) has issued a preliminary notification on 10 May 2000 concerning a future withdrawal of the compulsory statutory iodisation of salt and has invited views and suggestions from the general public within 45 days.*

*No State in India is free of iodine deficiency. Protect the people of India and its future generations from mental retardation by supporting universal salt iodisation.*

*Write to the Secretary Health, Ministry of Health and Family Welfare, Nirman Bhawan, New Delhi 110 011, before 23rd of June and express your solidarity in support of the compulsory statutory iodisation of salt.*

*Thank you.*

# Universal Salt Iodisation (USI) in India :

## Issues, Facts, Implications and Recommendations - 1

| Issues | Facts | Implications | Recommendations |
|---|---|---|---|
| **I) Iodised Salt : Compulsory OR Choice ?**<br><br>Should we have compulsory Universal Salt Iodisation (USI) OR we should leave the choice to consumers? | 1) Govt. own policy decision in 1984 taken by Central Council of Health | 1) A Retrograde step, sinking 50 years of research and programme with one stroke | 1) Continue with Universal Salt Iodisation |
| | 2) India is a signatory to Convention on Rights of Children and a party to WHO/UNICEF/FAO decisions on Universal Salt Iodisation | 2) Experience has shown time and again in India and elsewhere that withdrawal of USI leads to re-occurrence of Iodine Deficiency Disorders and brain damage in children | |
| OK Table salt - iodisation<br>vs<br>NOT all salt (animals, agri) | 3) As of now, Over 110 countries in the world have compulsory USI<br><br>US, Germany etc. not done | 3) Those who are Below Poverty Line and who suffer the most from brain damage due to iodine deficiency do not then purchase iodised salt | Probably the most valid argument |
| | | 4) India exports salt iodised salt to SAARC countries and many countries in Africa & Asia | |

# Universal Salt Iodisation (USI) in India :

## Issues, Facts, Implications and Recommendations - 2

| Issues | Facts | Implications | Recommendations |
|---|---|---|---|
| **<u>II) More employment OR unemployment ?</u>**<br><br>It is alleged that many workers have been rendered jobless as a result of USI | 1) No ban on production of common salt. In fact, it is a raw material for iodised salt<br><br>2) Salt Department has given financial and technical assistance to form co-operatives<br><br>3) USI has created NEW jobs. Every salt iodisation plant has created new employment opportunities. India has 850 salt iodisation plants. | 1) NO ban on production of common salt .Continue to iodise salt as it has given rise to more employment. | 1) Consolidation, expansion and monitoring of existing policies for support to co-operatives<br><br>2) Provide marketing facilities to small scale salt producers<br><br>~~Sell~~ Buy directly for public distribution from small producers |

# Issues, Facts, Implications and Recommendations - 3

| Issues | Facts | Implications | Recommendations |
|---|---|---|---|
| <u>**III) Iodised Salt : Refined & Packaged OR Crystal and loose**</u><br><br>There is a general misconception that only refined and packaged iodised salt is effective | 1) Iodised salt is equally effective even if it is in crystal form and sold in needed quantities from large 50 kg bags<br><br>2) Only 17% of 42 lakh tons of iodised salt is refined and available in polypacks. | 1) People wrongly attribute the rise in price of salt to iodisation. In fact, the rise in price is a result of refining and its packaging in 1 kg poly packs & advertising<br><br>2) A total of 83% of iodised salt produced in the country is crystal salt and is sold in needed quantities from 50 kgs bags. The poor in the country habitually consume only this salt. | 1) The misconception on price rise as a result of iodisation should be cleared. The price rise is due to refining of salt, packaging and advertising<br><br>2) Initiate a major drive for promoting use of crystal iodised salt packed in 50 kg bags and sold in needed quantities. ✓<br><br>What will be the cost? Compare c non-iodised |
| <u>**IV) Iodisation & increase in price of salt**</u><br><br>There is a mistaken notion that iodisation has led to increase in price of iodised salt<br><br>comparative costs? | 1) Cost of iodisation per person per year is less than the price of cup of tea! (Only 50 paise per person per year) ?<br><br>2) Major cost i.e. 70% of both common salt / iodised salt is for transportation and packaging | 1) People compare the price of common salt sold loose with refined, packaged and branded salt. Compare like with like! The price of packaged common salt and packaged iodised salt are comparable. | 1) Below Poverty Line population should receive iodised salt at subsidized rates ✓<br><br>2) Use Public Distribution System specially in rural areas for sale of iodised salt. In fact, over 13 states have already done it. ✓ |

Outreach of PDS is poor in most states, so what is the guarantee that iodised will reach poor.

# Universal Salt Iodisation (USI) in India :

# Issues, Facts, Implications and Recommendations - 4

| Issues | Facts | Implications | Recommendations |
|---|---|---|---|
| **V) Universal Salt Iodisation OR Selective area-specific salt iodisation**<br><br>Where there is no iodine deficiency reported, there is a suggestion to leave the choice of buying salt to consumers | 1) Indian scientists have shown that NOT even a single state or UT is free from iodine deficiency as a public health problem<br>region or district-wise<br><br>Do a urinary iodine study | 1) When there are two types of salt available - common salt and iodised salt, people mistakingly thinking it is cheap, buy the common salt. Not buying iodised salt will cost their life dearer than buying common salt. | 1) Continue and expand awareness programmes on IDD to cover all sections of society |
| | 2) Iodine deficiency is present NOT only in sub-Himalayan areas BUT in pockets all over the country. In fact, more areas are being identified. | 2) Consumption of iodised salt even for those with no iodine deficiency is TOTALLY SAFE<br>at what level? | 2) Continue with Universal Salt Iodisation |
| | 3) Iodine deficiency disorders are EVEN present in Delhi, Mumbai, Chandigarh etc. | | |

Some evidence that even compulsory iodisation does not lead to iodised salt in many ~~ar~~ remote areas. Will an accountable, functional monitoring system funded by the Iodide donor lobby be established?

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Friend;-

Please attest on the letter sent along with this letter. Since time frame is very less, please do it fast. From this, it helps Govt to remove ban on salt. Since you get enough information from the attached letter, there is no need to give too much information in this regard. This is based on Gazette of India dated 20-5-2000.

Please reply to us also regarding your reply.

sd.
Satyavrata.

(PTO)

(2)

To
The Secretary,
MOHFW
Nirman Bhavan
New Delhi.

This letter is in understanding that GoI is thinking of removing the ban on non-iodised salt, as it is the most commonly used among our population. Since this is common man's view, I fully endorse the same.

Excessive iodine is harmful as told medically. Apart from this Govt should not intervene even in food habits of common man. Common man is paying more for salt now & this allows corruption & pilferage upto Rs 2500 crore. Therefore we request you to use iodine only as medicine. Let it not come to common man's kitchen.

This is to express wish to abolish ban on non iodised salts.

Sd

(1)

Reg. No. S. 66/89-90

Phone : 2281414
K.G.S. Nidhi : 2261967

# ಗಾಂಧೀ ಶಾಂತಿ ಪ್ರತಿಷ್ಠಾನ: ಬೆಂಗಳೂರು (ರಿ.)

# Gandhi Peace Foundation

BANGALORE CENTRE (Regd.)

Gandhi Bhavan, Kumara Park East, Bangalore-560 001.

No.......................... Date 12-6-2000

ಮಿತ್ರರೆ

ಇದರೊಡನೆ ಲಗತ್ತಿಸಿರುವ ಪತ್ರಕ್ಕೆ ಸಹಿ ಹಾಕಿ ಅದರ ಮೇಲೆ ಕೊಟ್ಟಿರುವ ವಿಳಾಸಕ್ಕೆ ಕಳುಹಿಸುವ ಕೃಪೆ ಮಾಡಿರಿ. ಸಮಯಾವಕಾಶ ಕಡಿಮೆ ಇರುವುದರಿಂದ ಈ ಪತ್ರ ತಲುಪಿದ ಕೂಡಲೆ ಬರೆದು ಕಳಿಸಿರಿ. ಇದರಿಂದ ಸರ್ಕಾರ ಉಪ್ಪಿನ ಮೇಲಿನ ಪ್ರತಿಬಂಧಕಾಜ್ಞೆಯನ್ನು ಹಿಂತೆಗೆದುಕೊಳ್ಳಲು ನೆರವಾಗುವುದಲ್ಲದೆ ಅದರ ಕೈ ಬಲಪಡಿಸಿದಂತೆಯೂ ಆಗುವುದು. ಲಗತ್ತಿಸಿರುವ ಪತ್ರದಿಂದಲೇ ಪೂರ್ಣ ಮಾಹಿತಿ ನಿಮಗೆ ದೊರೆಯುವುದರಿಂದ ಇದಕ್ಕಿಂತ ಹೆಚ್ಚು ತಿಳಿಸುವ ಕಾರಣವಿಲ್ಲ. ಭಾರತ ಸರ್ಕಾರದ ಅಸಾಧಾರಣ ರಾಜ ಪತ್ರ( Gazette of India, Extraordinary dt. Wednesday,20-5-2000) ದ ಆಧಾರದ ಮೇಲೆ ಈ ತುರ್ತು ಪತ್ರ ಬರೆಯುತ್ತಿದ್ದೇನೆ.

ನೀವು ಪತ್ರ ಬರೆದು ಹಾಕಿದ ಸಂಗತಿ ನಮಗೂ ತಿಳಿಸಬೇಕಾಗಿ ವಿನಂತಿ.

ವಂದನೆ ಸಹಿತ,

ತಮ್ಮ

ಸತ್ಯವ್ರತ

-ಸತ್ಯವ್ರತ

ವಿ.ಸೂ:- ಲಗತ್ತಿಸಿರುವ ಪತ್ರದ ಸಾರಾಂಶವನ್ನು ಸ್ವಂತ ಭಾಷೆಯಲ್ಲಿ ಬರೆದು ಕಳಿಸಬಹುದು.

ಡಾ. ಸುದರ್ಶನ
ಶ್ರೀ. ವಿವೇಕಾನಂದ ಗಿರಿಜನ ಕಲ್ಯಾಣ ಕೇಂದ್ರ
ಬಿ. ಆರ್. ಹಿಲ್ಸ್.
ಎಳಂದೂರು ತಾಲ್ಲೂಕು
ಚಾಮರಾಜನಗರ ಜಿಲ್ಲೆ
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19 JUN 2000

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ಇಂದ:

ಸ್ಥಳ :

ದಿನಾಂಕ :

ಗೆ,

ಸನ್ಮಾನ್ಯ ಕಾರ್ಯದರ್ಶಿಯವರಿಗೆ,
ಆರೋಗ್ಯ ಮಂತ್ರಾಲಯ, ನಿರ್ಮಾಣ ಭವನ,
ಭಾರತ ಸರ್ಕಾರ,
ನವ ದೆಹಲಿ.

ಸನ್ಮಾನ್ಯ ಸಚಿವರೇ,

ಜನ, ಸಾಧಾರಣ ಬಳಸುವ ಉಪ್ಪನ್ನು ಸಹ ಐಯೋಡಿಕೃತಗೊಳಿಸಿ ಮಾರಾಟ ಮಾಡಬೇಕೇ ಹೊರತು ಐಯೋಡಿಕೃತ ವಾಗದ ಉಪ್ಪನ್ನು ಮಾರುವಂತಿಲ್ಲವೆಂಬ ಭಾರತ ಸರ್ಕಾರದ ಮೇ 1998 ರ ಆಜ್ಞೆಯನ್ನು ವಿರೋಧಿಸಿ ಮಾಡಿ ಬಂದಿರುವ ಬಲವಾದ ಜನಾಭಿಪ್ರಾಯವನ್ನು ಗಮನಿಸಿ 10–5–2000 ದಂದು ಈ ಆಜ್ಞೆಯನ್ನು ಹಿಂತೆಗೆದುಕೊಳ್ಳುವುದೇ ಸೂಕ್ತವೆಂದು ಕೇಂದ್ರ ಸರ್ಕಾರ ಪರ್ಯಾಲೋಚಿಸುತ್ತಿದೆಯೆಂದು ತಿಳಿದು ಬಂದಿದೆ. ನಾನು ಸರ್ಕಾರದ ಈ ಕ್ರಮವನ್ನು ಸ್ವಾಗತಿಸುವುದಿಲ್ಲದೆ ಅದನ್ನು ಪೂರ್ಣ ಸಮರ್ಥಿಸುತ್ತೇನೆ.

ಅಗತ್ಯಕ್ಕಿಂತ ಹೆಚ್ಚಾಗಿ ಅಥವಾ ಅನವಶ್ಯಕ ಪ್ರಮಾಣದ ಐಯೋಡಿನ್ ಶರೀರಕ್ಕೆ ಹಾನಿಕರವೆಂದು ವೈದ್ಯಕೀಯ ಅಭಿಮತವಿದೆ. ಇದಲ್ಲದೆ ಆಹಾರ ಪದಾರ್ಥಗಳ ಸೇವನೆಯಂಥ ಅತೀ ಸಾಮಾನ್ಯ ಕ್ಷೇತ್ರದಲ್ಲಿಯೂ ಸರ್ಕಾರದ ದಂಡು ಪ್ರವೇಶ ಅಪಾಯಕಾರಿ. ಸರ್ಕಾರದ ಮೇಲಿನ ಆಜ್ಞೆಯ ಕಾರಣ ಜನ ಸಾಧಾರಣ ಈಗ ಖರ್ಚು ಮಾಡುತ್ತಿರುವುದಕ್ಕಿಂತ ಮೂರು ಪಟ್ಟು ಹೆಚ್ಚು ಖರ್ಚು ಮಾಡಬೇಕಾಗಿ ಬಂದಿದೆ. ಪರಿಣಾಮವಾಗಿ, 25 ಶತಕೋಟಿ ರೂಪಾಯಿಗಳಷ್ಟು ಭಾರಿ ಹಣದ ರಾಶಿಯು ಲೂಟಿಗೆ ಆಸ್ಪದ ಕೊಟ್ಟಂತಾಗುತ್ತದೆ. ಆದ್ದರಿಂದ ಐಯೋಡಿನ್ ಬಾಷ್ಠಿಯಂತೆ ಮಾತ್ರ ಉಪಯೋಗದಲ್ಲಿರಲಿ. ಅದನ್ನು ಅಡಿಗೆ ಪದಾರ್ಥವಾಗಿ ಬದಲಿಸುವ ಪ್ರಯತ್ನ ಬೇಡ. ಜನಬಳಕೆಯ ಉಪ್ಪಿನ ಮೇಲೆ ಹೇರಿರುವ ಪ್ರತಿಬಂಧಕಾಜ್ಞೆಯನ್ನು ಸರ್ಕಾರ ಕೂಡಲೇ ಹಿಂತೆಗೆದುಕೊಳ್ಳಬೇಕು.

ಸಹಿ ____________________

■ PUBLIC HEALTH

# Dilemma over iodisation

## As the Centre contemplates withdrawing the universal salt iodisation programme, opinion is divided on the wisdom of the move.

ASHA KRISHNAKUMAR

THE Central government issued a preliminary notification on May 10 announcing the withdrawal of the Universal Salt Iodisation (USI) programme, 16 years after it was started. The move has attracted sharp reactions, with supporters and opponents of the USI squarely divided on scientific, ethical, economic or legal grounds.

Essential for human survival and development right from the foetal stage, iodine is used by the thyroid gland to synthesise hormones. The average daily iodine requirement for an adult is 150 micrograms and any excess iodine is excreted by the kidney. No organ selectively stores iodine, nor is any plant rich in it as in the case of iron (drumstick leaves) or vitamins (mango).

Thyroid hormones play a crucial role in the first two years of life, when over 90 per cent of brain development occurs. Irreversible mental problems caused by iodine deficiency become apparent only after two years of age. Iodine deficiency at different stages – foetal, neonatal, adolescent and adult – causes debilitating effects leading to a spectrum of problems, such as stillbirth, abortion, high incidence of neonatal and infant mortality, congenital malfunction of organs, mental retardation, physical abnormalities (cretinism), deaf-mutism and goitre. These are collectively called iodine deficiency disorders (IDD). It is estimated that the intelligence quotient (IQ) levels of schoolchildren in iodine-deficient areas is at least 13 points lower than the average.

* conduct studies in all districts

Iodine is primarily obtained from food and water. IDD occur in areas where iodine is deficient in water and soil. Also, in some cases substances in the food can block iodine absorption, leading to IDD. Iodine is present in the topsoil and reaches human beings through the soil-plant-animal chain. It is present in plants in direct proportion to its content in the soil. Iodine deficiency can be made up through diet; this has been done all over the world since the 1920s. While iodine can be added to bread, drinking and irrigation water and cooking oil, the most effective and cheap way is by iodising salt. Specified amounts of potassium iodide or iodate is added to salt during its manufacture.

USI is practised in 130 countries. India, which introduced the USI programme in May 1984, is a signatory to several international conventions, including the 43rd World Health Assembly (Geneva, May 1990), the World Summit for Children (New York, September 1990) and the South Asian Association for Regional Cooperation (SAARC) Conference (Colombo, September 1992), all of which aimed to eliminate IDD within a specified period.

Supporters of the USI programme in India quote studies by the Central and State Health Directorates and the Indian Council of Medical Research, which show that no State or Union Territory (U.T.) is free from IDD. Sample surveys in 26 States and six U.Ts reveal that the prevalence of IDD is above 10 per cent in 241 of the 282 districts covered. But the opponents of USI argue that the surveys are faulty. They say that the surverys are not based on a random sample but are biased towards high IDD-prevalent areas, and the figures obtained thus are extrapolated for whole States.

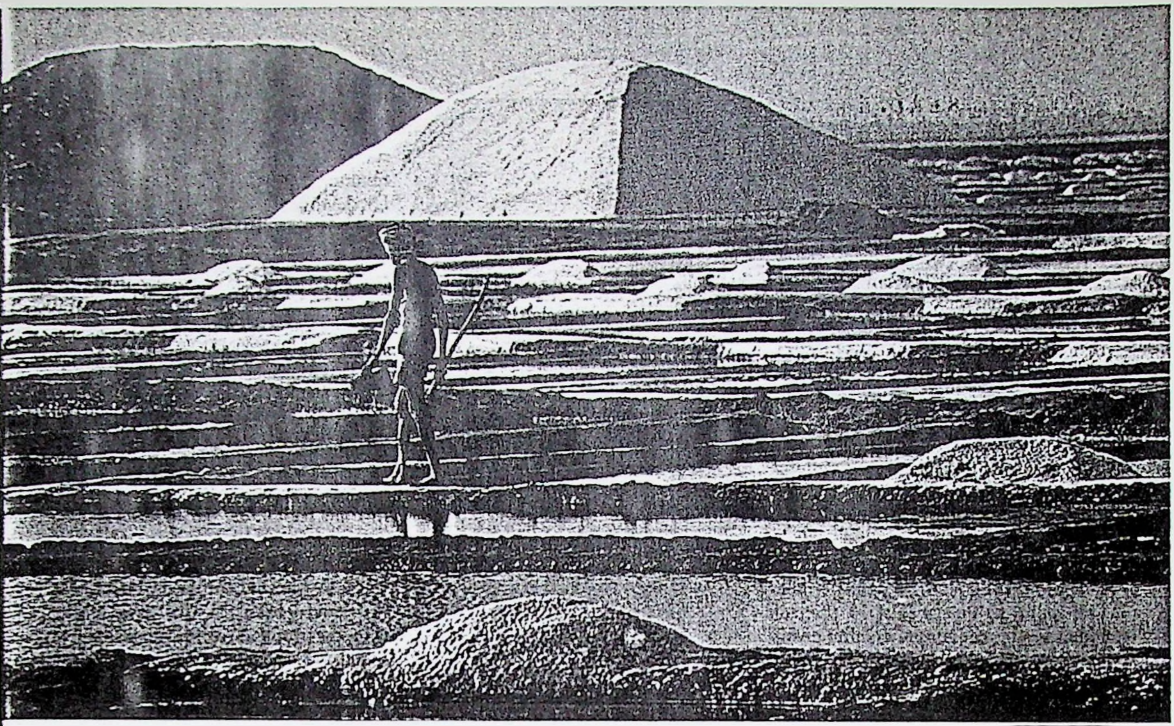
Of all known nutritional-deficiency disorders, IDD are the easiest to prevent yet, according to estimates available for India, there are two million cases of cretinism caused by iodine deficiency and 70 million persons suffer various forms of IDD. Another 200 million fall in the high-risk group.

Supporters of USI argue against conventional wisdom that only persons living in high-altitude areas, such as the Himalayan and sub-Himalayan regions, suffer from severe iodine deficiency as heavy rain and glaciation wash away the topsoil. They say that IDD were later found to be prevalent in the regions along the Ganga and the Brahmaputra as well because floods washed away the topsoil. Further, it was found that deforestation and intense agricultural practices also led to severe iodine depletion of the soil. Even coastal States such as Tamil Nadu and Kerala, which were thought to be iodine-rich (sea is rich in iodine), are not free from the problem. There are pockets of iodine-deficient areas in every State.

Opponents of USI argue that even in the mountainous terrain of the Himalayas, where IDD are endemic, there are pockets where cretinism is found in only a small segment of the population, between 1 and 4 per cent. In other parts of the sub-Himalayan region, the incidence is uniformly below 1 per cent. Kerala Sastra Sahithya Parishad (KSSP) member K.P. Aravindan said: "In the supposedly new endemic areas...the methodology adopted for proving the incidence of IDD involves developmental and intelligence testing, which is highly controversial and riddled with *a priori* assumptions, conscious fraud and politics, its very value of scientific objectivity is in question."

Recognising the severity of IDD in the Himalayan region and the benefits of iodine supplements from the study of the Kangra valley conducted by former Director of the All India Institute of Medical Sciences (AIIMS) and the ICMR, Prof. V. Ramalingaswamy, the Centre initiated the National Goitre Control Programme (NGCP) in 1962 to identify endemic iodine-deficiency areas, supply iodised salt to these areas and conduct periodic resurveys to assess the impact of the programme. After a promising start, the programme fizzled out.

Even after nearly four decades of the national programme, epidemiological information on IDD is either not available or, when available, is anecdotal or insufficient to allow any meaningful inference and planning. For example, of the 132 districts surveyed by the NGCP, 122 were termed endemic goitre areas. This conclusion, according to Aravindan, is suspect as the sample (in Uttar Pradesh, Bihar and West Bengal) was mostly from the hills and foothills; the plains were not



**At a salt pan in Pondicherry. The cheapest and most effective way to counter iodine deficiency is iodising salt.** GOUTAM GHOSH

included. But the results were extrapolated for the States as a whole.

However, following the setting up of the NGCP, the Centre set up salt iodisation plants in Rajasthan and Gujarat. The state-owned Hindustan Salts was given the monopoly for the production of iodised salt, but its units were unable to produce the required quantity. For instance, in 1981, seven lakh tonnes of iodised salt was needed to cover the endemic areas, but the installed capacity was only 3.76 lakh tonnes and the production only 1.3 lakh tonnes.

Critically reviewing the working of the NGCP, a former Director of the National Institute of Nutrition, Dr. C. Gopalan, called for a working group to look into the problem of IDD. This committee, along with the Central Council for Health, recommended in 1984 USI or a ban on the sale of non-iodised salt on the grounds that it was difficult to prevent the entry of non-iodised salt in the endemic goitre areas. The problem was widely prevalent in the country. Besides, the use of iodised salt by people without iodine deficiency was not considered harmful. The recommendation was to be implemented in phases from 1986, with total salt iodisation by 1992. The iodine content in salt was to be monitored by the monitoring information system of the Salt Department in various States.

The working group also suggested that production could be increased by involving the private sector with some subsidy (this was removed in 1992). Following this, a number of big producers, including some multinational corporations, entered the market and today there are 848 iodised salt units, 70 per cent of them big producers. Food being a State subject, several States went to court challenging the Centre's decision. All States except Kerala (no ban), Andhra Pradesh (partial ban) and Maharashtra (partial) have, however, banned the sale of non-iodised salt. (Tamil Nadu imposed a ban three years ago.) However, realising that non-iodised salt was still consumed by people in IDD-endemic areas (as common salt was sold for livestock's consumption), the Centre, on November 27, 1997, issued a notification in "The Gazette of India Extraordinary" to make the implementation of the USI programme stringent. Today 70 per cent of the population has access to iodised salt and the country is nearing the goal of complete elimination of IDD.

USI supporters say that India has made substantial progress since the launch of the programme. For instance, 65 per cent of the population in Deorea, Uttar Pradesh, suffered from some IDD in 1973; the figure fell to 18 per cent in 1998. In Buldhana, Maharashtra, IDD affected 49.5 per cent of the population in 1984, but the figure came down to 16.9 per cent in 1991. In Sikkim, the incidence dropped from 54 per cent in 1990 to 16 per cent in early 2000. Since the early 1990s, no cretin has been born in the once-endemic Terai region.

Pending final notification of the withdrawal of USI, the programme's proponents and opponents have been vocal about their respective stand. Several scientists have criticised the government's decision – among them are Ramalingaswamy; Dr. Chandrakant S. Pandav, Regional Coordinator (South Asia and Pacific) of the International Council for Control of Iodine Deficiency; Col. R. Sankar, Disorders Special Medical Specialist of the Institute of Nuclear Medicine and Allied Sciences (INMAS); Prof. M.G. Karmarkar, president of the Thyroid Association of India; Prof. N. Kochupillai, Head of Endocrinology at the All India Institute of Medical Sciences (AIIMS); Prof. M.M. Godbole, Head of Endocrinology at the Sanjay Gandhi Post Graduate Institute (Lucknow); and Dr. Umesh Kapil, Additional Professor of Human Nutrition Unit at the AIIMS. President of the Academy of Nutrition Improvement Prof. Shantilal Kothari (Nagpur), member of the All India Sarva Seva Sangh Prof. Thakurdas Bang (Wardha), member of the Vinoba Ashram Dr. Jagdish Shah, and the

Sarvodaya leaders at the Gandhi Peace Foundation have supported the move.

Broadly, the focus is on the following issues:

Effects of excess iodine: USI's opponents argue that excess iodine would cause hyperthyroidism, leading to iodide goitre (goitre caused by high iodine intake), iodine-induced thyrotoxicosis (induced by hyper-functioning of the thyroid gland) and sequelae of a possible increase in salt intake (hypertension caused by an increase in salt consumption as iodised salt is presented by multinational corporations (MNCs) as a restorative tonic with powers to cure anything from dullness to squint). Its supporters say that salt iodisation in India is within "safe limits". In India, common salt is iodised with potassium iodate to an iodine content level of 30 parts per million (ppm) so that at least 15 ppm of iodine reaches the consumers after possible transit loss. Even if there is no iodine loss and the consumers take in 30 ppm of iodine, scientists argue that it is within safe limits.

Role of big corporations: Of the 44 lakh tonnes of iodised salt, only 17 per cent is refined (powdered, bleached, packeted and labelled) – branded or otherwise. The rest is sold loose as crystal or powdered iodised salt. There is little doubt that companies such as the Tatas, Hindustan Lever and Nirma, which have entered the iodised salt market, make huge profits. USI's supporters argue that MNCs continue making huge profits with or without USI. The solution lies not in withdrawing the USI, but regulating the iodised salt market.

**Imported iodine cartel:** USI's supporters argue that only Chile and Japan export iodine. The iodine required for salt iodisation is a minuscule quantity compared to its need for the photo film, pharmaceutical and food processing industries, the primary sectors for which iodine is imported in India.

**Marginalisation of the small-scale sector:** This is true in some traditional salt-producing areas such as Gujarat and Tamil Nadu. According to USI's supporters, the solution to the problem of salt producers in the small-scale sector being marginalised by the major manufacturers is to help the small producers set up iodisation plants, organise them into cooperatives and help them market their product. The government can also consider buying iodised salt from the small producers and sell it through the Public Distribution System. Of the 848 iodised

G S K PILLAY

**A Sikkimese woman in a region where cretinism and goitre are endemic.**

salt units, 31 per cent, accounting for 26 per cent of the total production, is owned by small producers.

Costlier salt: USI's supporters argue that this is not because of salt iodisation, which has a nominal cost. It is estimated that iodising a kilogram of salt costs 10 paise. Big companies, traders and retailers make huge profits by buying iodised crystal salt (at between Rs.1.50 and Rs. 2 a kg) from small manufacturers and then after the powder-bleach-pack-labelling process sell it (at between Rs.4 and Rs. 5.50 a kg). USI's supporters argue that this can be avoided if the government buys iodised crystal salt and sells it at a reasonable price to those who need it, or buys common salt from small producers, iodises it in its iodisation plants and then sells it. The traders, who procure common salt from small producers and iodise, bleach, pack and sell it account for 31 per cent of the total iodised salt output in the country.

There is no administered price mechanism for iodised salt. Hence there is free trade and no price control. To make iodised salt available to the vulnerable sections, which need it most, 20 States and U.Ts sell it through the PDS, either wholly or partially.

According to Dr. Shantilal Kothari, who opposes USI, it is better to treat IDD like any other medical problem and leave it to the doctors to decide who needs additional iodine and to what extent. Anupam Mishra of the Gandhi Peace Foundation says that USI is not advisable as iodine is not totally benign and its excess consumption could lead to hyperthyroidism, resulting in health complications. While Dr. Jagdish Shah agrees that IDD is a problem in India, he believes that USI is not the way to address the problem.

A supporter of USI, Dr. Chandrakant S. Pandav, says: "The Centre's move is retrograde. There is no scientific, legal, economic, social, educational, moral or ethical justification for it." He argues that the cost-benefit ratio of salt iodisation is 1:3; if the gains from iodising livestock are also included, the ratio rises to 1:8. "The annual cost of salt iodisation per person is 50 paise, less than that of a cup of tea," he says.

According to him, the problems of consuming iodine when you do not need it is insignificant compared to the benefits derived from the USI programme. Also, the people at risk are those who live in isolated areas and who are a part of the vicious cycle of poverty, ignorance and disease. If both common salt and iodised salt are available in the market, they would buy only common salt as it may be cheaper. Dr. Pandav asks, "if the government can push universal immunisation and pulse polio, why not USI?"

According to Col. Sankar, if the government withdraws the USI, the most needy will suffer. The small manufacturers who sell iodised crystal salt, which the poor and vulnerable in the rural areas buy, would do away with iodisation and sell only common salt, while refined branded iodised salt will continue to be sold in the urban markets. So, according to Col. Sankar, even if the USI programme is withdrawn, the government must ensure that iodised salt reaches the people who need it most and at a reasonable price. It can be sold through the PDS and the government must absorb the price differential between common and iodised salt. And, at the same time, the government must initiate a study to map the incidence of IDD in the country with a representative sample. Reliable data so generated would go a long way in dealing with the problem of IDD.

It is not clear whether the government, which has given time until June 24 for the public response to the preliminary notification, has a programme for the endemic areas if it withdraws the USI programme. The reaction from the Ministry of Health and Family Welfare, which put out the notification, is that it would discuss its plans after June 24. ■

# NUTRITION PAPER OF THE MONTH

*January 2000*

## *Short-term Effectiveness of Mandatory Iodization of Table Salt, at an elevated Iodine concentration, on the Iodine and Goiter Status of Schoolchildren with Endemic Goiter*

*Jooste, P.L., Weight, M.J., & Lombard, C.J.*

*American Journal of Clinical Nutrition, 2000; 71:75-80*

This study from South Africa shows the impact of salt iodization on iodine status and goiter among schoolchildren. Baseline goiter rates and urinary iodine excretion were measured one month before iodization of salt was made mandatory in 1995 in 565 children. Before 1995 salt iodization was optional, and it was estimated that about 15% of the salt in the study area was iodized. A follow-up survey was conducted in 1996 among another cross-sectional sample of schoolchildren using the same sampling and data-collection procedures. In 1996, 82% of salt samples collected from children's households contained more than 20 ppm iodine, indicating the success of the salt iodization law. The goiter prevalence in 1995 was about 26%, and was virtually unchanged in 1996 at about 28%. However, the distribution curve of urinary iodine concentration shifted significantly to the right. Median iodine concentration was 0.17 μmol/L in 1995 and was increased to a value of 1.47μmol/L in 1996.

Several points can be concluded. Firstly, making iodization of salt mandatory lead to a quick increase in the availability of iodized salt which had a clear impact on iodine intake/status. Even with about 18% of the salt being inadequately iodized, urinary iodine concentration increased significantly. Secondly, in spite of the clearly improved iodine intake goiter prevalence remained unchanged, indicating that goiter prevalence is not a good indicator to monitor the impact of salt iodization over a relatively short period of time. Once the large majority of households use iodized salt, a representative survey of urinary iodine concentration needs to be done to check whether iodine intake is sufficient. Other studies showed that in iodine deficient areas such as this South African one, the IQ point distribution of the whole population shifts to the left. In the South African schools described in this study this IQ loss will now be prevented.

*UNICEF NYHQ*
*Nutrition Section, PD*

# Short-term effectiveness of mandatory iodization of table salt, at an elevated iodine concentration, on the iodine and goiter status of schoolchildren with endemic goiter[1,2]

*Pieter L Jooste, Michael J Weight, and Carl J Lombard*

ABSTRACT

**Background:** Goiter rates and iodine deficiency usually show marked improvement in efficacy studies of mandatory iodization of salt, but little is known about the short-term effectiveness of mandatory iodization.

**Objective:** The aim of the study was to evaluate, after 1 y, the effectiveness of mandatory iodization of salt at an iodine concentration higher than that occurring under optional iodization on the goiter rates and iodine status of schoolchildren living in an endemically goitrous area.

**Design:** Goiters, measured by palpation, and urinary iodine concentrations of children in grades 4–7 in 4 schools in a known goitrous area in South Africa were assessed before and 1 y after the introduction of mandatory iodization at a higher iodine concentration than occurred with optional iodization. Estimates of the iodine concentration of iodized salt and the proportion of households using iodized salt were also made.

**Results:** Iodine concentration in table salt and household use of iodized salt improved within 1 y. Goiter rates, which varied at baseline from 14.3% to 30.2% in the 4 schools, remained unchanged, with an overall mean (±SE) prevalence of 25.6 ± 2.5% at baseline and of 27.5 ± 2.7% 1 y later. The distribution of urinary iodine concentrations in the 4 schools improved substantially from the baseline deficient range. The overall median urinary iodine concentration increased from 0.17 to 1.47 μmol/L.

**Conclusions:** Mandatory iodization of salt virtually eradicated iodine deficiency within 1 y in South African schoolchildren, but the goiter rate in these children did not decline. Measurement of goiters by palpation may not be appropriate in short-term evaluations of mandatory iodization programs. *Am J Clin Nutr* 2000;71:75–80.

**KEY WORDS** Iodine deficiency, goiters, mandatory iodization, urinary iodine excretion, iodized salt, short-term effectiveness, South Africa, primary school children

## INTRODUCTION

Iodization of salt is generally considered a first-line public health measure for preventing and controlling endemic goiter induced by iodine deficiency (1–3). Although considerable success in eliminating or reducing endemic goiter has been achieved through national salt-iodization programs, eg, in Switzerland (4), endemic goiter persists in some countries with iodization programs and even in some with mandatory iodization programs (5, 6). Mandatory iodization of salt is therefore not an automatic guarantee of the elimination or reduction of iodine deficiency and endemic goiter.

Mandatory iodization of household salt was introduced in South Africa through revised legislation in December 1995. The salt-related regulations of the Foodstuffs, Cosmetics and Disinfectants Act No. 54 of 1972 were revised to make iodization mandatory rather than optional and to increase the concentration of iodine in the form of potassium iodate from 10–20 to 40–60 μg/g. As a result of this new regulation, the availability of iodized salt in food shops was expected to increase from ≈30% (7) to >90% within 6 mo.

The introduction of mandatory iodization has the potential to produce a chain of effects from the production plant to the household, including changes in iodine and goiter status of consumers. The success of such a program can be measured by monitoring key elements in this chain of events and evaluating the effects on consumers (8). We previously showed that introducing mandatory iodization in South Africa at a higher iodine concentration than that occurring with optional iodization resulted in a significant increase in the mean iodine content of retail salt from 14 to 33 μg/g within 1 y (9). Limited information is available on the short-term effect on the iodine and goiter status of schoolchildren of introducing mandatory iodization. The aim of this study was to investigate the effects of mandatory iodization after 1 y in schoolchildren in an endemically goitrous area.

## SUBJECTS AND METHODS

### Subjects

The study was carried out in the primary schools of 4 communities [Haarlem (school 1), Louterwater (school 2), Krakeel (school 3), and Joubertina (school 4)] in the Langkloof area, a 150-km-long

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Received March 11, 1999.

Accepted for publication June 4, 1999.

fruit-producing valley ≈70 km inland from the southeastern coast of South Africa. These 4 communities were chosen because the Langkloof area had been a focal point of studies on endemic goiter in the past (10). In addition, the socioeconomic status of the 4 communities ranged from low to high and there were sufficient numbers of schoolchildren. Children in grades 4–7 (ie, with 4–7 years of schooling) attending primary schools in the 4 communities, situated over a distance of ≈100 km in the Langkloof area, were used as subjects in both the baseline and follow-up studies. In the 2 biggest schools, every second child on the alphabetic class list was selected; in the remaining 2 schools, all the children in these grades were recruited. According to the headmasters of the schools, school attendance rates exceeded 90%. Written consent was obtained from parents or guardians of the children before each phase of the study began. Permission to conduct the study was also obtained from the headmasters and from the ethics committee of the South African Medical Research Council.

### Design

Baseline goiter rates, urinary iodine excretion, and related variables were observed in the schoolchildren of the 4 study communities in the month before the introduction of mandatory iodization of household salt in South Africa (10). Measurements were repeated 1 y later in a follow-up study that used the same sampling procedure (children in grades 4–7) to avoid age effects on goiter rates.

### Measurements

Identical sampling and data-collection procedures were used in the 2 surveys, which were conducted in the same month of 2 consecutive years. During each of these studies the size of the thyroid gland of each child was visually inspected and palpated and was graded according to the criteria of the World Health Organization, the United Nations Children's Fund, and the International Council for Control of Iodine Deficiency Disorders (11) as not palpable (grade 0), palpable but not visible (grade 1), or palpable and visible (grade 2). Different observers were used in the 2 studies but were standardized against each other. A urine sample (≈20 mL) was obtained from each participating child during usual school hours, corresponding to approximately the second urine void of the day. The urine samples were refrigerated at 4°C until they were analyzed for iodine content by means of manual acid digestion and spectrophotometric detection of iodine by ceric ammonium reduction in the Sandell-Kolthoff reaction (12, 13). Drinking-water samples were collected during baseline and follow-up from the municipal water supply in the 4 communities and were similarly analyzed. The analysis of urinary iodine content was standardized against the Centers for Disease Control in Atlanta in an ongoing quality control program at the time of the study. The CV of this analysis was 4.7% in our laboratory.

At baseline, when iodization was still optional, a short questionnaire completed by the children's parents was used to estimate the proportion of households that used iodized salt. At follow-up, to investigate the proportion of households using iodized salt and the iodine content of iodized salt used, we asked parents to put ≈15 g (3 tsp) of their table salt into iodine-free polyethylene bags provided through the schools. The bags were then tightly sealed until the samples were analyzed. Information on indicators of the socioeconomic status of the head of the household was generated by questionnaire. Several iodized salt samples were purchased from grocers in the area at the time of the baseline and follow-up studies and were subsequently analyzed for iodine content. The retail and household salt samples were analyzed quantitatively for iodine by using an iodometric titration method (14), for which the CVs in our laboratory were 0.68 at 20 μg/g and 1.05 at 60 μg/g.

### Data analysis

Follow-up data were not obtained for individual children, but the same sampling procedure was used in the same study population at both sampling times. The overlap between the 2 samples was therefore unknown and could have exceeded 50%. It can be shown that considering the 2 samples as completely independent in the statistical inference represented a conservative approach. This was the result of not using the intrasubject correlation that was present in the portion of the samples that overlapped. The chi-square test was used to compare the prevalence of goiters, and the median 2-sample test was used to compare the age and urine iodine distributions of the baseline and follow-up observations. Year-specific prevalence was estimated, with adjustment for the sampling design and realization.

## RESULTS

In 1995, a total of 565 children (71–189 per school) participated in the baseline phase of the study (**Table 1**). In 1996, a total of 536 children (50–184 per school) were recruited into the study. These numbers represented response rates ranging from 74.7% to 97.9% for the different schools in 1995 and from 51.5% to 94.4% in 1996, giving overall response rates of 84.3% and 81.7%, respectively. The low response rate at follow-up in school 4 was due to a lack of motivation to participate. The mean age of the total sample of children of 12.6 y in 1995 and 12.5 y in 1996 did not differ significantly (median 2-sample test, $P = 0.1238$) between the 2 study phases. Data on indicators of socioeconomic status showed a higher level of education, fewer laborers, and more professional people among the heads of households in the school-4 community than in the other 3 communities (Table 1).

Total goiter rates, consisting of the sum of the palpable (grade 1) and visible (grade 2) goiters, in the 4 communities before and 1 y after the introduction of mandatory iodization are shown in **Figure 1**. At baseline, the severity of the prevalence of goiters ranged from mild in school 4 (14.3%) to moderate in schools 1 (26.3%) and 2 (25.0%) to severe in school 3 (30.2%). The prevalence of goiters in these schools remained essentially unchanged 1 y later, and the overall weighted prevalence of 25.6 ± 2.5% ($\bar{x}$ ± SE) in 1995, adjusted for the sampling effect and response rate, did not differ significantly (chi-square test for a difference in proportions) from the overall weighted prevalence of 27.5 ± 2.7% 1 y later.

The distributions of urinary iodine excretion at baseline and 1 y after the introduction of mandatory iodization for each of the 4 schools are shown in **Figure 2**. Before mandatory iodization came into effect, these distributions were skewed toward the low urinary iodine concentrations, particularly in schools 1, 2, and 3, all of which were of low socioeconomic status. In these 3 schools, 39.4%, 55.6%, and 76.6% of children had urinary iodine concentrations in the severely low range (<0.16 μmol/L) and very few (<10%) had urinary iodine concentrations in the adequate range (>0.79 μmol/L). In the fourth school, a low percentage of children (1.5%) had severely low urinary iodine concentrations,

TABLE 1
Characteristics of the study population

| | School | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | School 1 | | School 2 | | School 3 | | School 4 | | Overall | |
| Characteristic | 1995 ($n$ = 155) | 1996 ($n$ = 156) | 1995 ($n$ = 189) | 1996 ($n$ = 184) | 1995 ($n$ = 150) | 1996 ($n$ = 146) | 1995 ($n$ = 71) | 1996 ($n$ = 50) | 1995 ($n$ = 565) | 1996 ($n$ = 536) |
| Response rate (%) | 92.8 | 92.3 | 97.9 | 94.4 | 70.1 | 74.6 | 74.7 | 51.5 | 84.3 | 81.7 |
| Age (y)[1] | 12.7 ± 1.8 | 12.4 ± 1.8 | 12.5 ± 1.8 | 12.6 ± 1.6 | 12.9 ± 2.0 | 12.7 ± 1.9 | 12.1 ± 1.0 | 12.0 ± 1.0 | 12.6 ± 1.9 | 12.5 ± 1.7 |
| Education[2] | | | | | | | | | | |
| ≤7 y (%) | — | 49.0 | — | 61.4 | — | 61.5 | — | 8.0 | — | 52.2 |
| ≥12 y (%) | — | 8.7 | — | 5.5 | — | 2.1 | — | 54.0 | — | 10.5 |
| Occupation[2] | | | | | | | | | | |
| Laborer (%) | — | 49.0 | — | 64.1 | — | 43.4 | — | 6.0 | — | 49.6 |
| Professional (%) | — | 5.3 | — | 2.2 | — | 0.7 | — | 30.0 | — | 5.6 |

[1] $\bar{x}$ ± SD.
[2] Refers to heads of households.

about a quarter had adequate urinary iodine concentrations, and the rest were moderately deficient (0.16–0.39 µmol/L) or mildly deficient (0.4–0.78 µmol/L). One year after the introduction of mandatory iodization, these urinary iodine distributions shifted substantially to the right toward higher, or adequate, concentrations (median 2-sample test, $P < 0.0001$ for all 4 schools) (Figure 2). In schools 1, 2, and 4, >80% of the children had urinary iodine concentrations >0.79 µmol/L at follow-up: 78.5% of the samples in school 3 were in this range.

Similarly, the median urinary iodine concentrations in the 4 schools increased markedly from concentrations indicating severe (school 3), moderate (schools 1 and 2), and mild (school 4) iodine deficiency at baseline to concentrations well into the replete range (0.79–1.58 µmol/L) 1 y later (**Table 2**). During this time the overall median urinary iodine concentration increased from 0.17 to 1.47 µmol/L (median 2-sample test, $P < 0.0001$).

The iodine content of 4 samples of retail iodized salt purchased in the study area at the time of the baseline study ranged from 14 to 17 µg/g ($\bar{x}$: 15 µg/g), ie, within the range of 10–20 µg/g that was legally required before the introduction of mandatory iodization. At follow-up 1 y later, 18 samples were purchased from retailers in the area. The iodine content of these retail samples increased to a mean of 25 µg/g, somewhat below the revised legal requirement of 40–60 µg/g that came into effect with the introduction of mandatory iodization. There was considerable variation in the iodine content of these retail salt samples at follow-up, ranging from 0 to 56 µg/g, resulting in a lower mean value than expected. The higher salt iodine concentration in community 4 than in the other communities was probably related to the higher socioeconomic status of these communities, which would have allowed them to purchase the more expensive brands of salt that had higher iodine concentrations.

To assess the change in the proportion of households using iodized salt as a result of the introduction of mandatory iodization, we established the baseline percentage of households that used iodized salt by questionnaire and used titrimetric analysis to determine the iodine content of salt samples brought to school at follow-up. At baseline, a low percentage of households (6.2% in

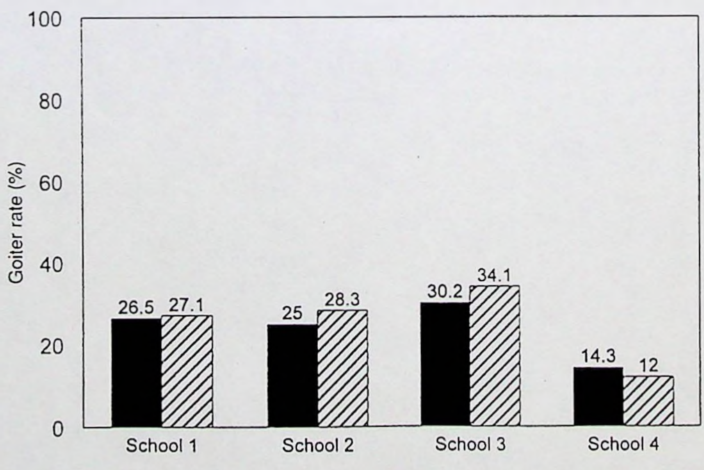


**FIGURE 1.** Total goiter rates in schoolchildren before (■) and 1 y after (▨) mandatory iodization, at a higher concentration than occurred with optional iodization, began.

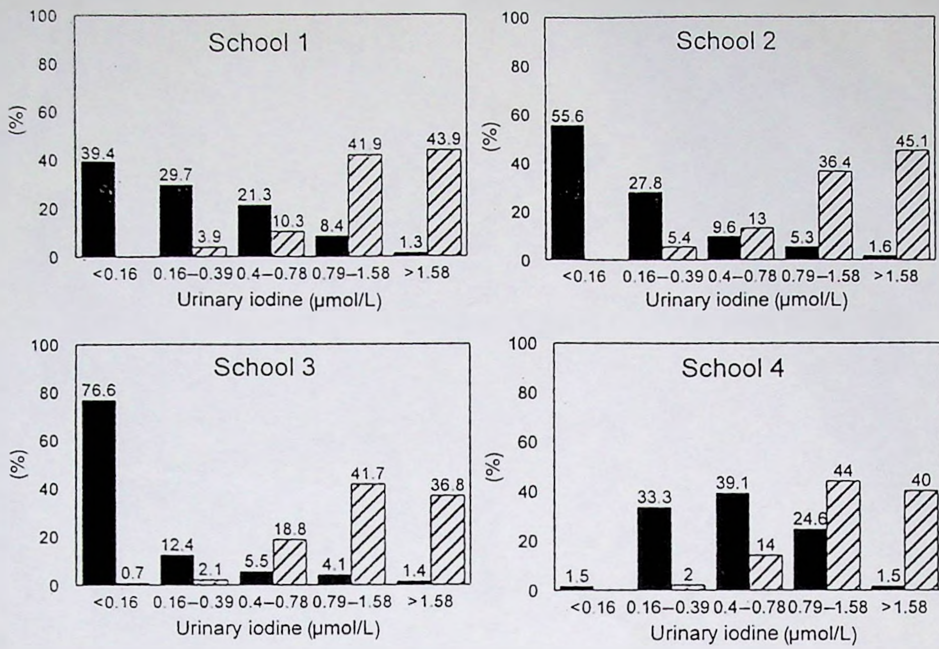


FIGURE 2. Distribution of urinary iodine concentrations in schoolchildren before (■) and 1 y after (▨) mandatory iodization, at a higher concentration than occurred with optional iodization, began. To convert values to μg/L, divide by 0.0079.

school 1, 4.3% in school 2, 25% in school 3, and 45.7% in school 4) reported the use of iodized salt. A year later, >70% of households in each of the communities, for an overall percentage of 82.4% in the whole study area, were using salt iodized at a concentration of >20 μg/g (Table 2). Overall, 15.1% of households had table salt with an iodine concentration within the legally required range of 40–60 μg/g (Table 2), although this required range applies to the production site. In the 3 communities of lowest socioeconomic status, the mean and median iodine concentrations of household salt were very similar, ranging from 24 to 34 μg/g; in the community with the highest socioeconomic status (school 4), mean and median concentrations were higher, exceeding 40 μg/g (Table 2). For the study area overall, the mean (±SD) household iodine concentration was 31 ± 17 μg/g and the median was 29 μg/g.

During both studies, the iodine concentrations of the drinking-water samples taken in the 4 communities remained low, between 0.0 and 0.12 μmol/L.

## DISCUSSION

At baseline, rates of iodine deficiency and goiter ranged from mild to severe in the 4 schools, despite the fact that optional iodization had been in operation in South Africa since 1954. The overall baseline prevalence of goiters of 25.6% (range: 14.3–30.2%) was, however, lower than the excessively high rates of between 69% and 93% that prevailed in this area ≈60 y ago (15, 16). Therefore, optional iodization at a concentration between 10 and 20 μg/g and a 30% market share of iodized salt with unequal accessibility (7), as was the case in South Africa for 4 decades before the introduction of mandatory iodization, appeared to have had some beneficial effect but was ineffective in eradicating iodine deficiency and endemic goiter in the study area.

Favorable changes were observed in the process indicators between baseline and follow-up, such as the increase in the proportion of households that used iodized salt and the increase in the iodine concentration of table salt. At baseline, the estimated overall percentage of 15.5% of households using iodized salt appeared to be lower than the national estimate of a 30% iodization rate of table salt before the introduction of mandatory iodization (7). These estimates were in striking contrast with household use of iodized salt in the study area 1 y after mandatory iodization was introduced, when 82.4% of households were using salt with an iodine concentration >20 μg/g (and 90.9% were using salt with an iodine concentration >10 μg/g). Moreover, the mean iodine concentration of retail salt samples collected during this study increased from 15 μg/g (range: 14–17) to 25 μg/g (range: 0–56) 1 y after the introduction of mandatory iodization. The latter mean value was lower than the mean value of 31 μg/g in household salt because of some very low concentrations among the retail salt samples. In another study, conducted in 3 of the 9 provinces in South Africa at the same time as the present study, we showed that the iodine concentration of retail salt increased from a mean of 14 μg/g before mandatory iodization to 33 μg/g 1 y after mandatory iodization was introduced (9). Although the iodine concentration was lower than the legally required concentration of 40–60 μg/g at the production site, it nevertheless validated the observation of an increased iodine concentration in iodized table salt over the study period. On the basis of the improvement in these process indicators, a

**TABLE 2**

Iodine concentrations in the urine of schoolchildren at baseline and at 1-y follow-up and in salt used in the children's households (collected at 1-y follow-up)

| | School | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | School 1 | | School 2 | | School 3 | | School 4 | | Overall | |
| Iodine | 1995 | 1996 | 1995 | 1996 | 1995 | 1996 | 1995 | 1996 | 1995 | 1996 |
| Urinary iodine | | | | | | | | | | |
| *n* | 155 | 155 | 187 | 184 | 145 | 144 | 69 | 50 | 556 | 533 |
| Median (μmol/L) | 0.21 | 1.52 | 0.13 | 1.52 | 0.04 | 1.34 | 0.51 | 1.42 | 0.17 | 1.47 |
| Iodine in household salt | | | | | | | | | | |
| *n* | — | 149 | — | 182 | — | 144 | — | 48 | — | 523 |
| $\bar{x} \pm$ SD (μg/g) | — | 24 ± 17 | — | 33 ± 14 | — | 30 ± 12 | — | 43 ± 26 | — | 31 ± 17 |
| Median (μg/g) | — | 24 | — | 34 | — | 28 | — | 47 | — | 29 |
| Percentage of salt samples with | | | | | | | | | | |
| >20 μg/g | — | 71.8 | — | 89.0 | — | 87.5 | — | 75.0 | — | 82.4 |
| 40–60 μg/g | | 14.1 | — | 15.9 | — | 10.4 | — | 33.3 | — | 15.1 |

similar improvement was also expected in the associated outcome indicators, ie, higher urinary iodine concentrations and a reduction in goiter rates.

Unlike the long-term successful reduction of goiter rates resulting from salt-iodization programs in many countries (1–5), the goiter rates in this study remained unchanged 1 y after iodization became mandatory at a higher iodine concentration than occurred with optional iodization. Although palpation of the thyroid is subject to observer variation (17), the similarity in the varying goiter rates of the children in the 4 schools before and after the introduction of mandatory iodization suggests internal consistency in the data, indicating a strong likelihood of a true lack of change in goiter rates in the short term.

Short-term success in reducing goiter rates was achieved in efficacy studies with iodized oil (18) and low-dose iodine (0.2 mg/d) (19) in adults but not in children receiving biscuits and cold drinks fortified with iodine (20). Todd and Dunn (21) observed reduced thyroid volumes, measured by ultrasound, in their efficacy study in 7–13-y-old children over a 13-mo period after the administration of potassium iodide given at a dosage of 30 mg monthly or 8 mg biweekly. Administration of iodized oil to schoolchildren aged 6–11 y as single iodine doses ≤480 mg did not result in decreased thyroid volumes as measured by ultrasonography over a period of 395 d (22). Only at a higher iodine dose of 960 mg (administered orally) or 480 mg (administered intramuscularly) did the goiter volume decrease significantly after 395 d (22). In our evaluation of the short-term (1 y) effectiveness of mandatory iodization of table salt, the prevalence of goiters in children in the 4 schools remained the same despite the dramatically improved iodine status of these children. Reasons for the lack of change in the goiter rates may be related to insufficient time of exposure to mandatory iodization, the insensitivity of thyroid palpation to small changes in thyroid volume (17), a lesser effectiveness of iodized-salt prophylaxis in reducing the size of goiters in children exposed to iodine deficiency in the first years of life (23), or the possibility that long-standing goiters may become autoimmune (24). This failure of mandatory iodization to induce regression of goiters that are mild-to-borderline severe in children suggests that assessment by palpation of the change in goiter rate may not be an appropriate short-term indicator of the effectiveness of salt-iodization programs.

The dramatic shift toward higher values in the urinary iodine distributions and the similarly impressive increases in the median urinary iodine concentration of children in the 4 schools illustrate the short-term effect of mandatory iodization on an outcome indicator such as urinary iodine excretion in schoolchildren. It is unlikely that factors other than the introduction of mandatory iodization at a higher concentration, which was associated with the favorable changes in process indicators previously alluded to, were responsible for this marked improvement in the iodine status of the children. The iodine concentration of drinking water remained low throughout the study period and sales of seafood, according to the managers of grocery stores in the study area, also remained unchanged.

However, 10–19% of the urine samples from the different communities still had iodine concentrations in the deficient range. Further follow-up studies are required to determine whether these results represent a steady state in urinary iodine concentration or whether further improvement can be achieved over a longer period of exposure to mandatory iodization.

Only table salt—and not salt used for agricultural purposes—is being iodized in South Africa. Strictly speaking, this does not conform to the definition of universal salt iodization, which extends to iodization of salt for animals. However, the introduction of mandatory iodization complied with part of the international mid-decade goal of universal salt iodization, resulting in a remarkable reduction in iodine deficiency in schoolchildren within 1 y.

The generalizibility of these results depends to a large extent on whether a national iodization program can be effectively implemented, whether iodized salt can be distributed efficiently, and whether consumers have unrestricted access to iodized salt. Our data showed that introducing mandatory iodization at a higher concentration than occurred with optional iodization resulted in improved process indicators, ie, a significantly higher mean iodine concentration of table salt and a markedly greater percentage of households using iodized salt, within 1 y. In turn, these changes in process indicators were responsible for the increased dietary intake of iodine, which virtually eradicated the mild-to-severe iodine deficiency in schoolchildren of 4 different communities. However, the goiters in these children did not regress within 1 y, leaving doubt about the appropriateness of assessing goiter by palpation in short-term evaluations of the effectiveness of iodization programs.

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Sustaining Elimination of IDD

ICCIDD

“I would be hard-hearted enough to let the sick die if you can tell me how to prevent others from falling sick.”

15/06/2000 urgent

Dear RAVI,
you may find it very interesting.
Thanks & regds
yours
Spruthvi

[signature] 17/6 To RN

“Io ... is so e ... that ... let ... be born m ... icapped for that reason.”

I'm for Iodised Salt. Are you?

When you eat **iodised salt** daily, you prevent these disorders.

These disorders are **invisible and irreversible.**


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17/6/2000

**WITHDRAWAL OF RESTRICTION ON SALE OF COMMON SALT FOR DIRECT HUMAN CONSUMPTION**

**Ministry of Health & Family Welfare, Department of Health**
**New Delhi, May 11, 2000**

**"I would be hard-hearted enough to let the sick die if you can tell me how to prevent others from falling sick".**

**- Mahatma Gandhi**

**"Iodine deficiency is so easy to prevent that it is a crime to let a single child be born mentally handicapped for that reason".**

**H. Labouisse**
**Executive Director**
**UNICEF, 1978**

We are enclosing information on the relevance and importance of Universal Salt Iodisation for the elimination of Iodine Deficiency Disorders as a public health problem in our country.

The purpose of this communication is to assist you in taking informed decision on the need for Universal Salt Iodisation in India. As intimated in the Government Press release, you may wish to communicate your considered opinion on whether you agree or disagree with the Governments proposed amendment to the Prevention of Food Adulteration Act. **This has to be communicated to the Secretary, Ministry of Health and Family Welfare, Government of India, Nirman Bhavan, New Delhi 110 011 latest by 24th June, 2000.**

With best personal regards,

Yours sincerely,

**Prof. V. Ramalingaswami**
**National Research Professor**
**AIIMS, New Delhi**

**Prof. M.G. Karmarkar**
**President,**
**Thyroid Association (India)**
**New Delhi**

**Prof. N. Kochupillai**
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## WITHDRAWAL OF RESTRICTION ON SALE OF COMMON SALT FOR DIRECT HUMAN CONSUMPTION

**Ministry of Health & Family Welfare, Department of Health**
**New Delhi, May 11, 2000**

1. This statement concerns a PRESS NOTE issued by the Ministry of Health & Family Welfare dated May 11, 2000, the operative part of which says : "The Central Government has issued a preliminary Notification proposing a future withdrawal of the compulsory statutory iodisation of edible salt".

2. Tragically, this proposition, conceived by the Government in the Department of Health, is unthinkable and anti-public health. Iodine is an essential nutrient for human survival and development. It is a constituent of the thyroid hormone which is necessary for growth and development of humans from the earliest stages of foetal life in the mother's womb. The thyroid hormone thyroxine ($T_4$) and its effector metabolite tri-iodo-thyronine ($T_3$) control normal body metabolic processes from womb to tomb.

3. Humans (and animals) are critically dependent on an external supply of relatively small but adequate amounts of iodine through food and water which, in turn, is dependent upon the iodine content of the soil. Over the millennia the iodine in surface soils in some parts of the world had been progressively leached out by glaciacion at elevated altitudes, snow, rain, and repeated flooding in reverine valleys and thus carried into the sea. Most of the iodine on our planet exists in the sea. The ecological profile of the Indian sub-continent with its hilly and mountainous terrain and frequent floods in the reverine valley systems makes it vulnerable to low iodine content of its soils

and thus to low nutritional iodine intakes by its inhabitants. Iodine deficiency, in turn, leads to enlargement of thyroid gland-goitre, and to increased frequencies of cretinism, deaf-mutism and other forms of developmental disorder. **These in fact are only the tip of the iceberg.**

4. Over the past five decades, Indian scientists have made contributions, widely acknowledged, to our present state of knowledge about iodine deficiency, which forms the basis of current public health policy regarding iodine deficiency throughout the world including India. These, in essence, are :

4.1 Brain damage is the most devastating component of iodine deficiency in intrauterine and the first three years in the life of the child leading to a global consensus on iodine deficiency as the single most preventable cause of brain damage in the population. Iodine deficiency is among the most extensive obstacles to human development. It results in lower intelligence and poor school performance of children. **It has been estimated that, on an average, school children living in iodine deficient areas have an IQ level lower by 13 IQ points than those living in iodine abundant areas.** Iodine deficient children display poor concentration, impaired coordination and sluggishness with diminished energy. A special contribution of Indian scientists to this most important feature of iodine deficiency relates to children just born to iodine deficient mothers living in iodine deficient area, showing an extremely high frequency of neonatal hypothyroidism reflecting **diminished function of the thyroid at the very start of life itself.** This is due to no fault of the mother or child or indeed of the family. **Is it not the right of the child to receive adequate iodine for its normal growth and development?**

**4.2** Recent estimates in India indicate that about 200 million people are at risk of iodine deficiency while 70 million manifest visible signs such as goitre. Out of 282 districts surveyed so far, 241 are found to be endemic for iodine deficiency. **These surveys clearly demonstrate that no State or Union Territory is totally free from iodine deficiency. They include hitherto unsuspected areas including the National Capital Territory of Delhi, Mumbai and Chandigarh!** Early in the course of these Indian researches and due to a close connection between research and public health action, the Government of India launched a National Goitre Control Programme in 1962 through public distribution of iodised salt in iodine deficient areas. But as the supply of iodised salt was restricted only to those districts which had obvious evidence of iodine deficiency and as the other neighbouring districts were allowed to continue the use of non-iodised salt which was freely available, the Programme did not succeed due to logistic difficulties in preventing non-iodised salt going into iodine deficient areas. The experience was similar in some other developing countries. With further knowledge accruing in later years and the realisation of the vast dimension of the consequences of iodine deficiency not just restricted to goitre and cretinism, thus revealing the true nature of the problem as a form **of hidden hunger, its bulk lying beneath the surface**, the concept of Universal Salt of Iodisation (USI) in countries with iodine deficiency became established. **The concept of USI implies iodised salt for all people, at all times.**

4.3 Iodine supplementation can be provided by adding iodine to salt, oil (for oral consumption or intramuscular injection), bread, drinking water, irrigation water, given as iodine tablets or added to other edible items such as fish, sauce, toffees, etc. In the Indian context, salt seems to be the most appropriate vehicle for supplementation of iodine. Salt is a commodity consumed in a fixed quantity on a daily basis by rich and poor, as well as by urban and rural populations.

4.4 **If the area in question is iodine deficient** (proven by low urinary iodine levels), then there is no dispute that iodine should be supplemented and there should be a ban on the sale of non-iodized salt in that area. Even in this area, if there are some people who are iodine sufficient, extra daily consumption of 150 g of iodine by these people is unlikely to cause them any harm. **If the area under question is iodine sufficient,** then additional iodine consumed because of salt iodization, would be only 150 g/day which would again not cause any medical problem. Therefore, the only question to consider here would be the increase in the cost of iodized salt being consumed by the population.

4.5 There is also an apprehension that because of salt iodisation, the price of salt has increased apparently helping the big companies. This perception is not correct. Only 17% of the iodised salt produced in our country is refined salt. The remaining 83% is produced by the medium and small manufacturers.

The economics of salt iodisation is given in Table – 1. The main cost is contributed by transportation, wholesale and retailers margin and the polypacks.

**Table 1 : Economics of Salt Iodisation**

| | |
|---|---|
| 1) Cost of iodine for salt iodisation | 3.5 paise / kg |
| 2) Cost of power, labour | 5.0 paise / kg |
| 3) Cost of loose crystal salt at production level | 45.0 paise / kg |
| 4) Cost of 1 kilo poly pack | 100 paise / kg |
| 5) Transport by rail / road | Rs. 1 – 3 / kg |

The retail price of the iodised salt is given in Table – 2.

**Table 2 : Retail prices of iodised salt**

| Type of salt | Price (Rs.) |
|---|---|
| Crystal iodised salt in loose | Rs. 1.50 – 2.00/ kg |
| Powdered iodised salt in loose | Rs. 2.00 – 2.50/kg |
| Powdered iodised salt packed | Rs. 2.50 – 4.00/kg |
| Refined iodised salt (Branded) | Rs. 5.50 & above/kg |

It is important to note here that most of the salt available in rural areas is in the form of crystal iodised salt, sold loose and is in the price range of Rs. 1.50 to Rs. 2.50 per kg. As is evident from the above facts, this cost is not a substantial issue considering the enormous benefits of iodised salt for brain growth and development.

4.6 Recently from developed countries like U.S.A. and Australia, reports are coming which indicates re-emergence of iodine deficiency in these countries. When iodine deficiency is present during pregnancy, even in milder form, it may lead to neuro-pyschological deficits in the children born to these women. The iodine intake in these countries is going down because of change in practice of washing milch animals udders with hot water instead of iodine-containing compounds that contributed to the extra iodine in the milk in the past. It is estimated that in U.S.A., 15% of the women in the reproductive age group have iodine excretion less than 50 µg/litre, which according to the WHO indicates moderate iodine deficiency. These countries, in view of the high literacy rates and purchasing power, give option to the people for buying iodised or non-iodised salt. The above recent scientific information has prompted the USA government to sanction US $ 5 million to update the iodine status in USA. This experience should make us wiser and therefore, we should continue Universal Salt Iodisation even in those areas of India which are apparently, "iodine sufficient".

4.7 In the present context it is not possible to leave the choice of using iodized or non-iodized salt to individuals in the community. To do so, would involve considerable inputs from the point of view of public education and public health. Therefore, considering the cost:benefit ratio, it would be better to have universal salt iodization for the whole country. While discussing this, we have to keep in mind the principles of public health according to which the health of the overall community takes precedence over the health of a few individuals or that of a small segment of the population. Thus, if a segment of the population living in an iodine-sufficient area is consuming salt fortified with iodine which is unlikely to cause any major medical problems, this itself should not prevent universal salt iodization in our country.

4.8 The Kangra Valley experiment, considered a classic in public health, clearly demonstrated that adding a small physiological amount of iodine to common salt either in the form of iodide or iodate protects all children against the development of ill-effects of iodine deficiency. During the past 30 years of the study, no adverse reactions of significance have been observed in this population. Other options such as iodised oil, bread, milk, sauce, water etc. for delivery of iodine had been considered. But salt in view of its obligatory daily consumption in fixed quantity, and at low cost, has been accepted as the vehicle of choice for delivering iodine to all iodine deficient population groups in the world.

5. Taking into account this large knowledge base about the ill-effects iodine deficiency to which Indian scientists have made significant contributions, the Central Council of Health, the highest governmental body in the field of health in India, consisting of Health Ministers from all the States of India presided over by the Union Health Minister and usually inaugurated by the Prime Minister took an **informed and historic decision in 1984 to universally iodinate all edible salt in India by 1990 giving the highest priority to hyper-endemic areas.** The control of endemic goitre had been included in the Prime Minister's New 20-Point Programme. Elimination of iodine deficiency on this planet of ours was advocated by the World Health Assembly in 1990, by World Summit for Children in the same year, by the International Convention on the Rights of the Child and by the SAARC conference for Children in 1992. India is a signatory to all these resolutions. **Since then, a sea change had been taking place in the Indian scene.** Salt industry had been mobilized resulting in increased production of iodised salt from a mere 200,000 tonnes in 1983 to 40 lakh tonnes in 1998. All the states with the exception of Kerala had issued Notification prohibiting the sale of salt other than iodised salt for edible purposes. Free trade prevails for iodised salt; however, with a view to make iodised salt available to the most vulnerable groups, 20 states and Union Territories have included iodised salt in the Public Distribution System list fully or partially.

6. India is making significant advances in the elimination of iodine deficiency. Over 70% of the population now has access to adequately iodised in India. **India and several other developing countries are almost on the brink of eliminating iodine deficiency**. The Director General of the World Health Organization, Dr. Gro Harlem Brundtland, addressing the World Health Assembly last year, said : **"When elimination of IDD is achieved, it will be a major and total public health triumph ranking with small-pox and poliomyelitis". Soon India will be free from an age-old scourge affecting millions upon millions of its people.** Throughout the millenniums behind us iodine deficiency had been a stealthy drag on the physical, mental and social

development of its people. **The present PRESS NOTE issued by the Government has the potential of sending wrong signals about the lack of interest of the government of India in the elimination of iodine deficiency**, thus leading to disarray, disaster and dismantling of what had been achieved so patiently, with mistakes made and corrected, and with Science solidly behind policy. **Now it would appear that policy had forsaken scientific advance, humanism and social development.**

7. If, as the Government Notification says no public health policy should be forced upon people against their free will, then what about universal immunisation of all children, chlorination of drinking water supplies, and so many other public health measures? Are we after Public Health or Health of the Public? How does government know that iodised salt for prevention of iodine deficiency is rejected by the people of India? For all we know from our repeated visits to and studies in the iodine deficient areas before and after the introduction of iodised salt, a major transformation is taking place. The wide prevalence of functional failure of the thyroid in different stages of the life cycle of people in these villages with impairment of human skills and learning abilities and productivity so characteristic of pre-iodisation scenario is yielding place now after iodisation to a scenario of obvious improvement. There is equally a remarkable improvement in the laboratory parameters of thyroid function – hypothyroidism at birth is significantly reduced, goitre prevalence is going down and urinary iodine levels are rising to normal.

   If the issue is one of loss of employment of some small scale producers of salt in some parts of the country, efforts are being made to form salt co-operatives and give them free equipment and other facilities for salt iodisation. The Salt Commissioner of the Government of India says that, with iodisation, employment opportunities had increased. In any case the problem can be sorted out by mutual discussion of concerned parties without halting a major national programme.

8. Iodisation is essentially a preventive measure, it prevents future generations of children from failing to reach their full genetic potential in cognitive ability, learnability, in enhancing productivity and in acting as members of society with dignity and honour.

Won't Gandhiji be delighted at the improved human development being witnessed today through correction of iodine deficiency by the provision of iodised salt? Indeed, he wrote many years ago in the Harijan :

> **"I would be hard-hearted enough to let the sick die, if you can tell me how to prevent others from falling sick".**

**- Mahatma Gandhi**

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DR. PREM AGGARWAL
Hony. General Secretary

## PRESS RELEASE

8th April, 2000

This is matter of deep concern that a statement on behalf of the Prime Minister of India has been appeared in a newspaper recently that the compulsory iodization of the salt is going to be stopped in the country. It was also mentioned in the report that iodization of the salt is done on the behest of certain multinationals or the lobbies with vested interest. It is also a matter of concern that such an important socio-medical decision i.e. compulsory iodisation of salt or removing it has been done by the Prime Minister only on sheer market forces. Indian Medical Association strongly support of unique universal iodization of salt throughout the country and for the same I am mentioning the following points :

**The Problem**: Iodine deficiency disorders are one of the most common public health problems throughout India. Iodine Deficiency Disorders can be easily prevented by consuming iodized salt, Iodine Deficiency not only cause Goitre, it can also result in implied brain development in the fetus and infant and retarded physical and psychomotor development in the child. Even a small amount of iodine deficiency can lower mental functioning. Iodine deficiency is the commonest preventable cause of mental retardation in the world.

In the last 50 years, many countries in North America, Asia, Europe and Oceania have successfully eliminated IDD, or made substantial progress in its control, largely as a result of salt iodisation with potassium iodine or potassium iodate and through dietary diversification. For example, in Switzerland, where salt iodisation began in 1922, cretinism has been eliminated and goitre has disappeared. There has been no evidence of any adverse effects from iodine intake in countries with routine salt iodization.

**Progress in India:** Substantial progress has been made in India in the production of iodised salt from 3 lakh Metric Tons in 1983 to nearly 42 Lakh Metric Tons in 1997. Similarly, recent IDD surveys have revealed that more than 70 per cent of population is consuming iodised salt. Concurrently, the total goitre prevalence and incidence of neonatal hypothyrodism have also decreased. Estimations of urinary iodine exception levels amongst people indifferent states indicate that they have adequate iodine intake with iodization of salt.

Most salt is currently iodised according to reports on iodine content of salt samples analysed and received from different states through the Monitoring Information System (MIS) of the Salt Department. The production of iodised salt is increasing. Assessment of Thyroid Marker among goitre prone subjects countrywide show overall prevalence of thyrotoxicists of less than one per ten thousand population which indicate no increase in the prevalence of hypothyroidism among houtre zone subject to following salt iodisation. These findings indicate successful implementation of USI programme in India. Recently, the scientific journal "Nature" has commended the Indian Salt iodisation Programme as one of the most successful preventive public health programme amongst the developing countries.

Contd..2..

**Safety of Iodized** Salt in 1970, the Food and Nutrition Board of the National Academy of Sciences, USA, estimated that a daily intake of 1000 mcg of iodine is safe. In 1980, American Medical Association noted that no adverse physiologic reactions were observed with iodine intake up to 1000 mcg per day in healthy adults. Average daily intake of iodine in Japan has been reported be 3000 micrograms which is 20 times more than the RDA value of 150 mcg in India. From the average daily intake of 10 g iodine fortified salt, the estimated availability of iodine would be 150 mcg of which about 30 per cent is lost during cooking. The remaining 105 mcg is ingested and from this about 70 percent is absorbed by the body. This means approximately only 73.5 mcg is absorbed per day from iodine fortified salt. This quantity when added to the iodine consumed daily through food will be broadly comparable to the daily physiological need of the body. Indeed urinary iodine exception studies in the post iodisation phase show that all over the county, the level achieved following salt iodisation is not more than 300 mcg per day. Thus the level of iodine intake from iodised salt is safe in our county.

It is not correct to attribute skin reactions such as rashes and acne to iodised salt, Physiological levels of iodine intake do not cause "Iodism". For example, among 20,000 children in the USA suffering from allergy during the period 1935-1974, not single case was reported of allergic hypersenstivity to iodine in food. Following publication in Annals of Allergy of a request for notification of allergy to iodine, not a single report was recorded between 1974 and 1980.

Daily iodine intake of upto 1 mg, i.e. 1000 mcg, appear to be entirely safe. Iodization of salt at a level that assures an intake of 150-300mcg/day keeps iodine intakes well within daily physiological needs for all population, regardless of their iodine status. In India, daily consumption of 10 g of salt containing 15 parts per million of iodine would add a maximum of only 150 mcg of iodine. Thus, the likelihood of exceeding an iodine intake of 1 mg/day from iodized salt is quite small.

Whereas IDD is a public health problem in India;
Whereas it can be easily eliminated with the use of iodized salt;
Whereas it has been shown to be safe in India as in the rest of the world;
Whereas there have been objections raised by some ill informed groups on iodization of salt.

Indian Medical Association requests the Prime Minister and all the government agencies to take this important socio-medical issue having enormous impact on the public health not lightly and the compulsory iodization of salt should be the routine for the next century in the country which has no ill effect and extremely beneficial to the masses.

Dr. Prem Aggarwal
Hony. General Secretary

With 70% of population having access to iodised salt, India, which adopted the policy of Universal Salt Iodisation, is on the brink of elimination of IDD as a public health problem. The decade of 90's will be remembered how national governments, the salt industry, UN agencies, non-governmental organizations, scientists and practitioners from all sectors have collaborated in the global effort to reach the common goal of IDD elimination. The experience gained from such collaborative endeavour will open the door to new opportunities for accelerating progress in public health.

**Prof. V. Ramalingaswami**
**Keynote Plenary Lecture**
**8th World Salt Symposium**
**The Hague (Netherlands)**
**9th May' 2000**

**PRESS INFORMATION BUREAU**
**GOVERNMENT OF INDIA**

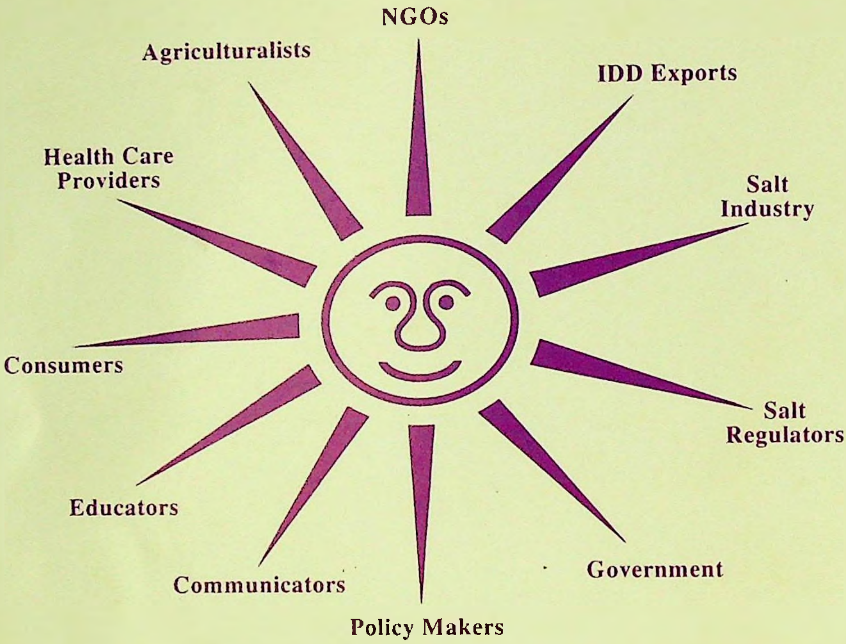
**PRESS NOTE**

**WITHDRAWAL OF RESTRICTION ON SALE OF COMMON SALT FOR DIRECT HUMAN CONSUMPTION**

As a part of its drive to prevent iodine deficiency disorders amongst the general public, the Central Government had issued a notification w.e.f. May 1998 making a mandatory for all manufacturers of edible salt to iodise their product. However, over a period of time, a strong view has been expressed that such a public health measure should not be enforced through statutory provisions. It has been widely perceived that any initiative in this regard to beneficial components of diet should be propagated through wide-spread publicity and dissemination of information. It has been argued that, on a point of principle, compulsion in such matters of individual choice, is undesirable. Taking such perceptions into account, on 10.5.2000, the Central Government has issued a preliminary notification proposing a future withdrawal of the compulsory statutory iodisation of edible salt. The preliminary notification has prescribed a period of 45 days for receipt of views and suggestions of the general public in this regard. After expiry of this period of 45 days, the Government will consider all the views received and take a final decision in regard on this issue.

**Ministry of Health & Family Welfare, (Department of Health)**
**New Delhi, Vaisakha 21, 1922, May 11, 2000**

ISBN No.: 81-86813-11-X




# Sustaining Elimination of IDD

ICCIDD

International
Council for Control of
Iodine Deficiency Disorders




# An International Iodine Lab Network...

Chclib - Iodine Resource file.
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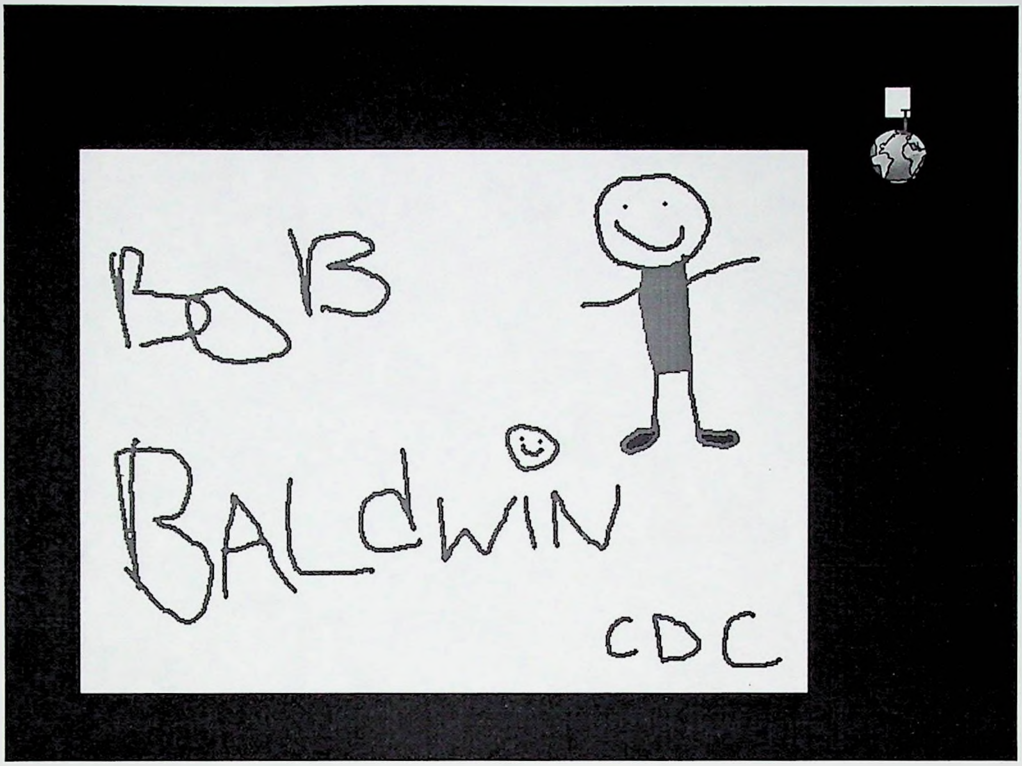
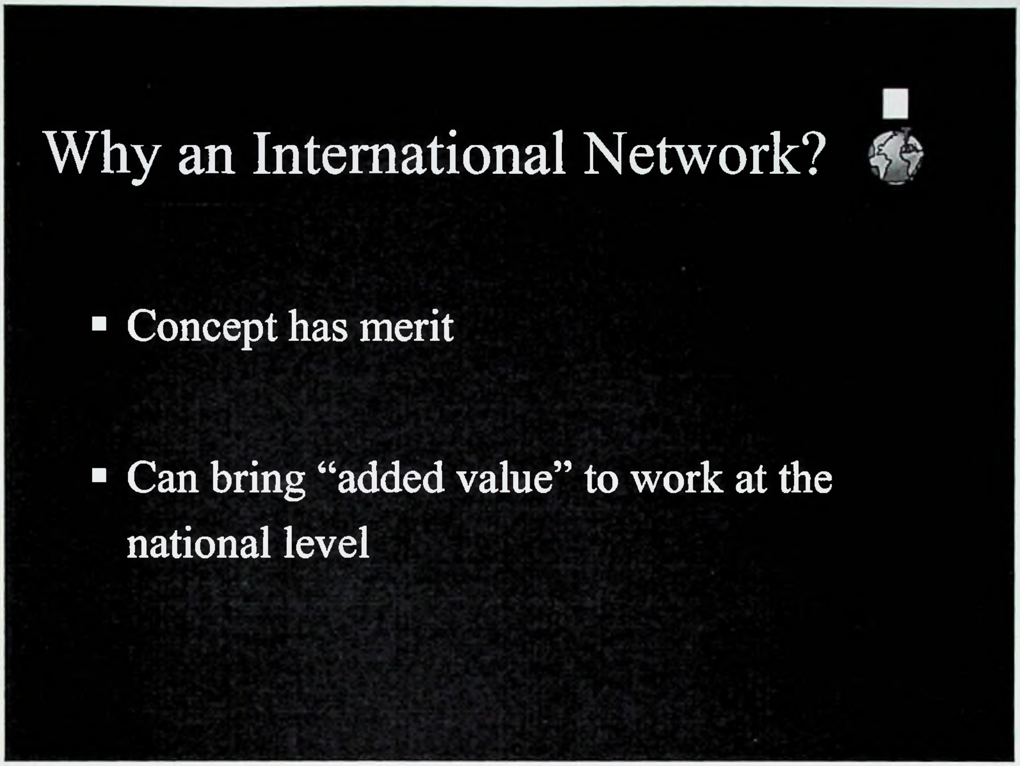

BOB
BALDWIN
CDC

# A Unique Conference...

- The goal was to lay the foundation for an international network, but at the same time addressed specific iodine quality assessment techniques.
- Much ground was covered in two days. One of the best organized meetings

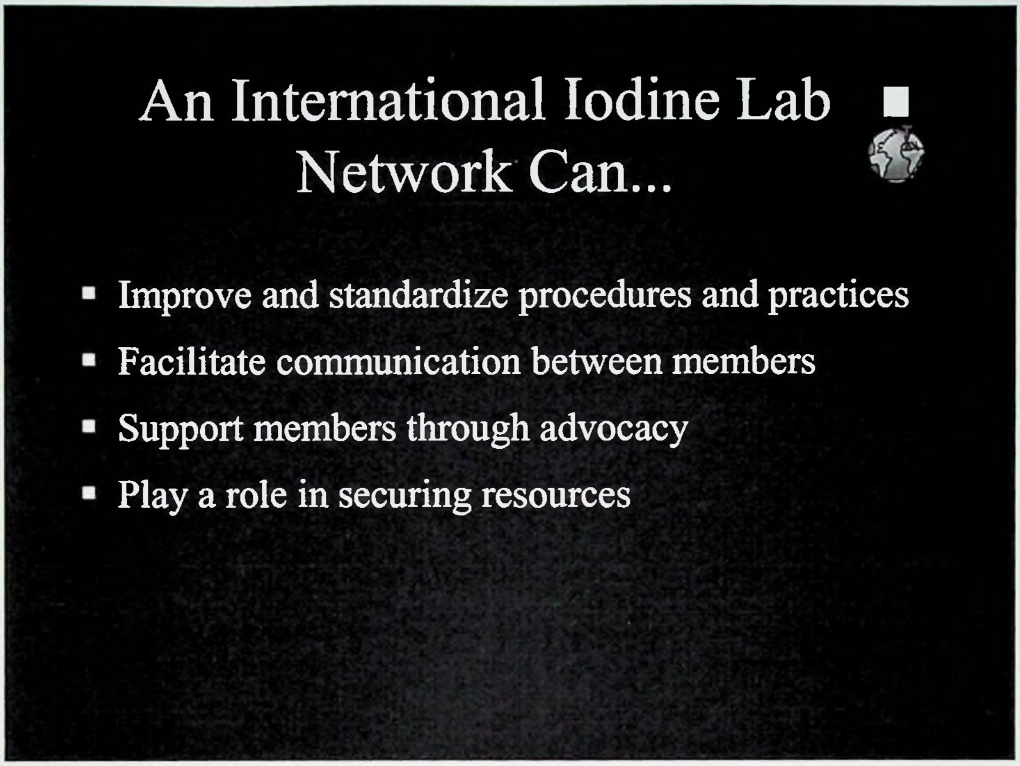
# A Unique Conference...

- Did not raise more questions than it answered
- Interesting mix of policy, lab personnel and salt industry
- Hope to have greater participation from the salt industry in the future


Why an International Network?
Concept has merit
Can bring "added value" to work at the national level

# An International Iodine Lab Network Can...

- Strengthen individual labs
- Facilitate the establishment of regional labs
- Develop capacity and provide training
- Provide cost-effective technical assistance within the region
- Strengthen assessment, monitoring, and evaluation


An International Iodine Lab Network Can...
Improve and standardize procedures and practices
Facilitate communication between members
Support members through advocacy
Play a role in securing resources

# We Are Not Starting From Ground Zero...

- Some labs, with modest resources, can become highly productive regional resource labs
- Build on the experiences of others

# A Proposed Plan of Action

- Recognized a need to create a simple plan of action
- Required by potential funding agencies
- Demonstrates seriousness of our intent
- Describes modest initial effort –both realistic and achievable

## A Proposed Plan of Action

- Shows incremental growth of the initiative
- Supplies potential funders with national budget
- Recognized that this is just a rough framework that requires further refinement

# Preparation for a Global Network - Year 1

- Form IDD Lab Network Secretariat, which will
  - ✓ Define selection criteria for regional resource laboratories
  - ✓ Select 1 laboratory per region (total of 6 regions) to be used as core trainers for future regional resource laboratories
- Workshop of core trainers to harmonize training materials for use in training of regional resource laboratories; explore possibility of distance-based learning where appropriate

# Development of Global Network Year 2 and 3

- Core trainers train regional resource laboratories preferably in both, urinary iodine and salt iodine testing with support from international agencies--TOT
  - ✓ Monitoring and data analysis (program managers)
  - ✓ Laboratory methods and quality management (laboratory managers)
  - ✓ Statistical procedures (program and laboratory managers)
- Core trainers identify needs for external funding for supplies and equipment in regional resource laboratories

## Development of Regional Networks Year 4 and 5

- Regional resource laboratories could build regional networks where required or desired
  - ✓Provide training
  - ✓Agree on common standards
  - ✓Develop regional quality assurance programs
  - ✓Promote optimal use of existing equipment and assess infrastructure needs

# Financial Needs

- Year 1:
  - ✓ Workshop for core trainers (12) - $50,000
- Year 2 and 3:
  - ✓ Each core trainer trains 2 regional resource laboratories in their country (6 regions) – $80,000
  - ✓ Equipment and supplies - $50,000
  - ✓ Site visits - $50,000
- Staff requirements for network activities
  - ✓ 2 at global level (secretariat) - $150,000/year
  - ✓ 1 in each region (total of 6) - $450,000/year

## Sustainability

- No easy answers
- Unable to come to grips with it in two days
- Solutions will have to be based on
  - ✓ Local needs and acceptable practices
  - ✓ Local political commitment
  - ✓ Creativity of national government and international organizations
  - ✓ PAHO revolving fund
- The initiation of the formation of the network should not wait on the resolution of all the sustainability issues

## Last But Not Least…

Special thanks to the CDC Team…

--Christine Pfeiffer
--Kathy Caldwell
--Mike Kinzer

for their tireless efforts, their endless patience and their cheerful natures.