Section VIII

Reports from the Regions and the Countries by ICCIDD Regional Coordinators (RC)

I

Introduction

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1.1 Classification of Countries by Iodine Nutrition

The Regions follow those established by the World Health Organization.

An Overview of the programs in each of the Regions is given with an Introductory Section on 'Lessons Learnt'.

Detailed data on the status of the program in each country by region is given in **Appendix 1**.

A classification of the iodine nutrition of countries by Regions is shown in the following Tables, which provide a background to the discussion in this Section. These data are provided from the ICCIDD Data Base. They have been compiled by Dr John Dunn, Executive Director of the ICCIDD and refer to the situation as of early 2003.

1.2 World Map Showing Iodine Nutrition by Country

These data are also shown in the World Map **(in between page 294 and 295).**

In addition detailed data on the status of each country program is given in **Appendix 1**.

Table 1. *Classification of African Countries by Iodine Nutrition*

Deficient			Likely		Likely		Status
Severe	Moderate	Mild	Deficient	Sufficient	Sufficient	Excess	Uncertain
Gambia	Ethiopia	Mauritania	Angola	Algeria	Botswana	DR Congo	Mali
Sierra Leone	Guinea	Mozambique	Burkina Faso	Benin	Egypt		W. Sahara
	Senegal	Zambia	Burundi	Cameroon	Eritrea		
	Sudan		Cape Verde	Kenya	Gabon		
			CAR	Madagascar	Liberia		
			Chad	Nigeria	Libya		
			Comoros	Rwanda	Malawi		
			Congo (Braz)	Togo	Namibia		
			Cote d' Ivoire	Uganda	Sao Tome		
			Equat. Guinea	Zimbabwe	S. Africa		
			Ghana		Swaziland		
			Guinea-Bissau		Tunisia		
			Lesotho				
			Morocco				
			Niger				
			Somalia				
			Tanzania				

Table 2. *Classification of South East Asian Countries by Iodine Nutrition*

Deficient			Likely		Likely		Status
Severe	Moderate	Mild	Deficient	Sufficient	Sufficient	Excess	Uncertain
	India	Maldives	Bangladesh	Bhutan			
			Myanmar				
			Nepal				
			Sri Lanka				

Table 3. *Classification of China/East Asian Countries by Iodine Nutrition*

Deficient			Likely		Likely		Status
Severe	Moderate	Mild	Deficient	Sufficient	Sufficient	Excess	Uncertain
		Mongolia	North Korea	China			

Table 4. *Classification of Asia/Pacific Countries by Iodine Nutrition*

Deficient			Likely		Likely		Status
Severe	Moderate	Mild	Deficient	Sufficient	Sufficient	Excess	Uncertain
		New Zealand	Australia	Thailand	Singapore	Japan	
		Philippines	Laos		South Korea		
			Papua New Guinea				
			Malaysia				
			Cambodia				
			Indonesia				
			Vietnam				
			Fiji				

Table 5. *Classification of Middle East Countries by Iodine Nutrition*

Deficient			Likely		Likely		Status
Severe	Moderate	Mild	Deficient	Sufficient	Sufficient	Excess	Uncertain
	Pakistan	UAE	Afghanistan	Iran	Bahrain		Kuwait
			Iraq	Jordan	Oman		
			Saudi Arabia		Qatar		
			Syria		Yemen		

Table 6. *Classification of Americas by Iodine Nutrition*

Deficient			Likely		Likely		Status
Severe	Moderate	Mild	Deficient	Sufficient	Sufficient	Excess	Uncertain
	Haiti	Bolivia	Guyana	Ecuador	Argentina	Chile	Surinam
	Dominican Republic	Guatemala		Peru	Brazil		
		Cuba		Venezuela	Colombia		
				Panama	Belize		
				USA	El Salvador		
				Paraguay	Honduras		
				Uruguay	Nicaragua		
					Canada		
					Mexico		
					Costa Rica		

Table 7. *Classification of West/Central European Countries by Iodine Nutrition*

Deficient	Sufficient	Likely Sufficient
Albania	Austria	Iceland
Belgium	Bosnia	Luxembourg
Denmark	Bulgaria	Norway
France	Croatia	Sweden
Germany	Cyprus	
Greece	Czech Republic	
Hungary	Finland	
Ireland	Macedonia	
Italy	Netherlands	
Romania	Poland	
Slovenia	Portugal	
Spain	Slovak Republic	
Turkey	Switzerland	
Yugoslavia	United Kingdom	
(Montenegro)	Yugoslavia (Serbia)	

Table 8. *Classification of East Europe/Central Asian Countries by Iodine Nutrition*

Deficient			Likely		Likely		Status
Severe	Moderate	Mild	Deficient	Sufficient	Sufficient	Excess	Uncertain
	Azerbaijan	Latvia			Armenia		
	Kazahstan	Lithuania					
	Tajikistan	Georgia					
	Uzbekistan	Belarus					
	Kyrgestan	Turkmenistan					
		Ukraine					
		Estonia					
		Russia					
		Moldova					

2

African Region

D Lantum, J Egbuta
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2.1 Overview

2.2 Cameroon

2.3 Nigeria

2.4 East & Southern Africa

2.1

Overview

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In collaboration with other
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2.1.1 Summary and Lessons Learnt

Africa has made great strides towards iodine sufficiency in the past 15 years. Approximately 23 of the 50 countries considered here, representing 59% of its population, appear to be iodine sufficient. The major push for iodized salt, currently used by about 62% of households, is chiefly responsible for this improvement. By comparison, the WHO/UNICEF/ICCIDD Conference concluded that virtually every African country had some iodine deficiency.

Much remains to be done. Over half the countries still harbour iodine deficiency, putting at least 330 million people at continuing risk for its consequences. The continent is only about halfway to its goal of virtual elimination of iodine deficiency by 2005, as pledged by the UN General Assembly Special Session (UNGASS) on children in May 2002. Strong efforts must be made towards more effective implementation of iodized salt, through stronger government programs, education, monitoring, and information gathering.

2.1.2 Introduction

Africa has over 800 million people, about 15% of the world's population. Virtually all of its countries have had iodine deficiency in the past. ICCIDD has periodically summarised overall progress, with frequent additional reports on individual countries or subregions (Ekpechi 1987; IDD Newsletter (1997, 1999). The present article offers an update, drawn principally from ICCIDD sources but in addition from UNICEF Country Offices (especially on iodized salt) and WHO as well as communication from various national and other commentators.

The data are presented in three tables and a map. They include all of geographical Africa, although North Africa is also grouped with ICCIDD's Middle East/North Africa region, and the ICCIDD regions differ slightly from those of WHO and UNICEF. However, information is frequently fragmentary or not available at all.

Table 1 presents a classification of countries by iodine nutrition status and **Table 2**, an overall summary. The entries reflect our best judgement from what is available. Still, information on many items, especially monitoring and education, cannot be readily found. Often data on the same subject conflict; for example, different surveys may report different levels of iodine in the salt or urine, and choosing the more reliable figure has been arbitrary. More details appear in the pages for individual countries in ICCIDD's CIDDS database (www.iccidd.org).

2.1.3 Urinary iodine

In accordance with WHO/UNICEF/ICCIDD (2001) recommendations, urinary iodine concentration is the major indicator of iodine nutrition. Deficiency is defined as either severe (median UI <20µg/L), moderate (20-49µg/L), or mild (50-99µg/L); sufficiency is 100µg/L or higher, and excess is >300µg/L. Several countries have had recent careful representative national surveys, but these are the exceptions. Often only regional surveys are available. Generally, information from urinary iodine concentrations correlates with that from goitre surveys when both are available. Almost no country has information about neonatal screening with TSH, a useful marker for iodine nutrition in more developed countries.

2.1.4 Legislation

Some type of legislation for salt iodization and IDD exists in 38 of the 50 countries, and is pending in another. Eight countries do not have relevant laws, and the situation is uncertain in Comoros, Somalia, and Sierra Leone. Potassium iodate (KIO_3)is the iodine compound used by all African countries, although it is frequently not clear whether the levels specified are for iodine *per se* or for KIO_3, of which only 58% is iodine. Wide variation exists in the specifications for iodine content of salt, ranging from 20-100ppm. Some countries specify a range, others a minimum, and still others prescribe different levels at production, retail, and household.

2.1.5 Iodized salt

Salt production is uneven across the continent; some countries import it, others export. Countries that import all of their salt (e.g., Congo, Nigeria, Zimbabwe, and Rwanda) have led the continent in implementation of iodized salt. For them, the major strategy has been effective control measures and inspection at the borders. Other countries may have many small salt producers scattered over a wide area, presenting a much greater challenge to effective iodization of their product.

Another important variable is the distribution of salt production between large and small operations. Large producers usually have more sophisticated technology that allows iodization to be introduced easily, and the management is more accessible to regulatory agencies and more compliant in observing quality control and the laws. Small producers are often spread over large areas and consist of single individuals or families; introducing iodization into their operations requires intensive education, technical support, and logistic arrangements.

The data on household use of iodized salt come principally from the UNICEF global database on IDD, compiled in 2000 (www.childinfo.org), occasionally supplemented by additional or more recent information. These surveys use different definitions for adequately iodized salt, but usually require at least 15ppm at the household level. Wide variation across the continent is evident, from virtually no iodized salt in Mauritania, Sudan, and Gambia to over 90% in Benin, Cameroon, DR Congo, Kenya, Libya, Namibia, Nigeria, Sao Tome, Togo, Tunisia, and Zimbabwe. By population, about 62% of households are covered with adequately iodized salt.

2.1.6 National programs

Most governments accept some responsibility for IDD control. The degree of involvement ranges from none in several countries to active programs with a designated government unit and a national coalition in others. Over time, many programs fluctuate in their activities, peaking with a survey and enthusiasm about salt iodization and enforcing national laws, and then ebbing with changes in personnel, financing, and advocacy.

Our knowledge about monitoring and quality assurance of salt is limited. A few countries, especially those that import salt, have good systems of quality control and monitoring. In most of the others, monitoring is uneven at best, and often there is no information.

Similarly, only a few countries have programs that actively monitor iodine nutrition. The surveys that have taken place from time to time are usually limited geographically and technically, relying on unrepresentative sampling of locales and only neck palpation. The more careful studies, such as done with the ThyroMobil, provide a uniform reliable technology, but are limited in the number of sites they can reach, particularly neglecting the distant rural poorer sites that typically harbour the most resistant iodine deficiency.

Information is also sparse about sustained education activities within countries. Many have proposed commendable plans for education at all levels, from politicians through the health sector to the community. The degree of penetration of such messages and their long-term effects are generally unknown.

2.1.7 Overall status

Table 1 places each country in a category ranging from severe iodine deficiency to excess. Significant, are the large numbers of countries in the “likely deficient” categories (17 countries, 120 million people) and “likely sufficient" (12 countries, 151 million people) as well as one without enough information to categorise. Thus, over half the countries lack enough information to allow a proper conclusion about their iodine nutritional status.

This analysis presents information by individual country, because programs and epidemiologic data are national. The largest of the countries considered here has a population nearly 1,000 times greater than that of the smallest. Even small and medium-sized countries have considerable diversity of geography, wealth, and nutritional status, and significant pockets of persisting iodine nutrition can easily be lost when averaged with the iodine sufficiency of other zones of the country. For example, Nigeria, Kenya, and South Africa appear sufficient, but need attention to possible continuing iodine deficiency in parts of their national territory.

ICCIDD has summarised Africa's iodine nutrition before **(Table 3)** although the previous tallies were not prepared in the same way. In 1987 few countries had data on urinary iodine, and conclusions were based on goitre prevalence by palpation. Many countries had virtually no information about iodine nutrition. Technology had improved somewhat by 1996, and urinary iodine measurement was coming into greater use. The summary in 1999 did not provide information on a number of countries, so its totals are smaller.

Despite these limitations, the data of **Table 3** show several trends. First, the number of countries that are sufficient, or likely sufficient, has increased steadily. Secondly, we have more and better information than before, although data are still incomplete. Even the countries that remain deficient show evidence of lesser degrees of deficiency over time. Examination of individual countries show some with striking improvement, such as Algeria, Benin, Cameroon, DR Congo, Kenya, Madagascar, Malawi, Nigeria, Rwanda, and Togo. In a few, the iodine deficiency has probably worsened, such as Sierra Leone and Ethiopia.

2.1.8 Recommendations

Many general recommendations can be made for African countries, including more effective implementation of iodized salt, more vigorous educational efforts, stronger program organization, and national coalitions for advocacy. Additionally, the present review emphasises three activities for urgent attention:

1. *More information* – This compilation clearly demonstrates how limited the data are for many countries. Missing information certainly

exists and needs to be found. ICCIDD through its Subregional Coordinators and National Representatives, and together with partners in WHO, UNICEF, and other organizations, will increase its efforts to gain a more complete picture of the current situation in countries, and thus improve planning for a more effective strategy.

2. *Adjustment of salt iodine levels* – The range of iodine concentrations for fortifying salt in Africa is quite wide. The amounts in some countries (e.g., Kenya, Eritrea, Niger, Uganda and Zambia) are very high and are likely to increase the risk of iodine-induced hyperthyroidism, as happened in Zimbabwe in the early 1990s. Salt moves across many national borders in Africa, and a fairly uniform standard for iodine content makes good public health and economic sense. Regional health and economic groups should convene to reach such a standard; previous workshops, particularly in Eastern Africa, have considered the issue, but with little follow-up.

3. *Monitoring* – Most countries in Africa have inadequate monitoring of both salt and iodine nutrition. Data on both indicators are essential for correcting delays in progress and for advancing sustainability. All programs should build a component for monitoring nutrition and salt into their overall strategy and dedicate some of their resources to it.

References

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2.2

Cameroon

Dr. Daniel N Lantum

2.2.1 Summary and Lessons Learnt

1. The sustained leadership role of International community (WHO/UNICEF/ICCIDD) was vital, and the continuing catalytic and teaching role of the **ICCIDD Focal Point** was central to the progress achieved.
2. A committed national multidisciplinary scientist capable of establishing partnership and networking was the driving force.
3. As Iodine laboratories are scarcely used, there is no need for one in every country but the titration of iodine in salt should be done at industrial level or at national quality control points by the local University Faculties of Science and Medicine.
4. Rapid turnover of trained personnel is injurious to the program.
5. Iodized salt producers must be supervised to sustain regular and adequate levels of iodization as well as supply information on progress of the national program of which they are the principal movers.
6. With the liberation of the salt trade, the control of salt marketing is imperative, as smart smugglers of non-iodized salt are a serious threat and could ruin the program in isolated districts.
7. Adequate coverage of the country with iodized salt reduces the effect of goitrogens (cassava, etc) consumed as food staples.
8. No national IDD program can be successful without extensive partnerships and networking. It is a serious error to confide programs to junior health technicians as leaders.
9. National coalitions are necessary to promote social mobilisation and sustained information, education and communication at the grassroots.
10. There were many individuals who joined the program primarily as business ventures with no commitment to IDD elimination, and when resources were scarce, they withdrew.
11. Access to mass media of communication is an essential program component to raise population awareness.
12. Regular program monitoring and publication of progress reports is necessary to win public interest and support, but resources were always scarce to do regular monitoring.
13. New scientific updates through 1986-2002 did alter program aspects including methods of data collection, types of data collected, units of measurement, interpretation of endemicity and cut-off levels for total goitre rates and urinary iodine excretion levels. This proved the importance of operational research done by ICCIDD and national scientists.

14. The ICCIDD Newsletter did help greatly to enlighten local leaders on what others were doing in other countries and thus encouraged us to keep up our effort.
15. Continuous human resource development and capacity building are a sine qua non for a national program that has no foreseeable end. The ICCIDD TASK FORCE, which later became the AFRICAN Micronutrient TASK FORCE did a lot in this domain through yearly workshops.

2.2.2 Introduction

The idea of conceiving the National Iodine Deficiency Disorders (IDD) Program in Cameroon and for most countries of Africa must be accredited to the WHO/UNICEF/ICCIDD IDD Regional Conference held in Yaounde, 21-24 March 1987. At this conference the concept of goitre, endemic cretinism and other IDD manifestations as being one continuum of diseases with a common cause, namely, iodine deficiency was well elucidated, the six phases of the social model of controlling an endemic disease well described, the patchy endemicity of IDD in Africa summarised and the different strategies for control of IDD well discussed, with universal salt iodization emerging as the choicest hope in the long run. Some of the outcomes of the meeting were the creation of an IDD African Task Force to help create country programs and the appointment of Professor Daniel Lantum as the ICCIDD Subregional Coordinator for Central Africa and Madagascar. In 1989 the WHO/ICCIDD sent out Mr. Venkatesh Mannar, a Salt Consultant to Cameroon and he and Professor Dan Lantum carried out a study of the salt trade in Cameroon, with particular reference to possibilities of iodization of all food grade salt at Douala, the principal Port-town of Central Africa. It was then that the Sel du Cameroun Preparation for the Cameroon National IDD Program began with the sponsorship in 1989 by WHO/ICCIDD of Dr. Jeanne Ngogang-a Biochemist Lecturer, to the All Indian Institute of Health Sciences, New Delhi, India, to learn the management of an Iodine Laboratory under Professor MGV Karmarkar. This was followed by support for the creation of an Iodine laboratory at the Faculty of Medicine and Biomedical Sciences (then CUSS/UCHS) to facilitate the community diagnosis of IDD and eventually to assure program monitoring. Eventually a laboratory technician was trained in CDC Atlanta by the Program against Micronutrient Malnutrition (PAMM). The CUSS team further extended their base to the National Centre for Food and Nutrition Research (CNRAN) and trained laboratory technicians for Democratic Republic of Congo, Tchad, Central African Republic and Gabon. They have also carried out urinary iodine analysis for these countries as well as Madagascar, but their commonest activity over the years has consisted of support for studies by medical students doing their Doctorate degrees on IDD, periodic monitoring of the national program, quality assessment and quality control for the many salt producers in Douala.

2.2.3 Community Diagnosis of IDD Endemicity

The endemicity of Iodine Deficiency Disorders (IDD) as a public health problem in Cameroon was established by Lantum and collaborators of the University Centre for Health Sciences of the University of Yaounde in 1990/1991 after a quasi-national survey and review of fragmentary information reported by isolated researchers between 1954 and 1990. It is worth mentioning that the German colonial records do mention that pockets of goitre were seen in parts of Cameroon by 1906; but it was Masseyeff of the French Organisation for Scientific and Technical Research (ORSTOM) who investigated large communities in the Batouri region of the East Province in 1954 and described it as hyper-endemic for goitre with Total Goitre Prevalence of 58%. He was soon followed in 1967 by Pele who worked at Akonolinga; then by Lowenstein (1968) under the auspices of the World Health Organization; Stephany and collaborators in Kadey division (1970). Robert Aquaron and others (1972 –1977) carried out urinary iodine surveys in several communities in East and West Provinces, thanks to his home base laboratory in Marseilles.

Our medical students then joined the battle under our supervision to carry out studies on IDD for their MD theses. They were Pierre Nguessi (1976), Lache Ben Eno (1981), Tembon Ardi Chi (1984), Verla Siysi (1989), John Ngum (1990) and Tchakounte (1991), and others. It was at this point that Lantum and others completed the quasi-national survey to compile evidence to establish the national Community diagnosis of a moderate IDD endemicity with average Total Goitre Prevalence of 29.4% based on data from 26 sentinel sites. The population at risk was estimated to be 5,654,044 out of 10.5 million population (1990), that is 53.8%. Clinically and biologically we found severe iodine deficiency, endemic goitre, hyperthyroidism, endemic cretinism, neonatal hypothyroidism, juvenile hypothyroidism, high infant and perinatal mortality and other indirect consequences of IDD **(fig. 1)**.

Fig. 1 *A cretin, 50 years old from North West Province, Cameroon with Dr. Kamga Fotso, August 1993.*

With the above convincing evidence, the Minister of Public Health decided to set up a national IDD control program by signing Ministerial Order: N° 0133/A/MSP/SG/DSFM/SDSF/SN of 29 May 1991 which was formally launched on 21st June 1991 at a Press Conference. By this legislative instrument, the strategy of Universal Salt Iodization and consumption was adopted, as it was quite feasible.

2.2.4 Program Evolution

We are grateful to the Private Salt Sector –the SELCAM Refinery– that agreed to iodize all their food-grade salt according to the standing legislation. They increased their production progressively and adequately covering the estimated annual national need of 33,000 tons till 1994 when other salt producers joined in when the salt trade was liberalised. In addition to production, this company carried out the marketing and distribution to all the corners of the national territory. The Faculty of Medicine and Biomedical Sciences (FMBS) undertook to do monitoring in the field using the rapid test kits, supported by titration of sub-samples, as well as carry out urinary iodine analysis periodically for urine samples collected from school children in selected sentinel sites. Thus they assessed iodized salt coverage, carried out goitre surveys in school children to establish current prevalence and compare with baseline levels in order to establish program impact according to eight convenient indicators: namely, Total Goitre Prevalence (TGP); presence of new cretins; House-hold coverage; iodine content in salt at production and at the periphery; consumer awareness of the program; increase in urinary iodine excretion levels; and population satisfaction.

The thyroid hormones T_4 *and* T_3 *plus TSH were assayed in the Hormone laboratory of the Institute for Medical Research and Medicinal Plants (IMPM) to determine the prevalence of neonatal hypothyroidism.*

In 1992 and 1993 national follow-up surveys were conducted to assess the extent of the availability of salt in the market chain (principal depots, retailers in rural districts, and at the household) as well as the yearly quantity and quality of iodized salt produced. Special detailed evaluations were carried out in selected sentinel sites to assess progressive impacts. UNICEF supported the Faculty to do an extensive impact evaluation in 1995 before the External Evaluation team visited in October 1995 to carry out their Seven African Country Study organised by WHO/UNICEF/ICCIDD. Soon after, since 1996 the Ministry of Public

Health joined in to do a yearly iodized salt coverage assessment at consumer level, which they have kept up till 2002.

The Inputs and Impacts of the Program between 1990/1991 and 1995 are presented in the following tables:

Table 1: Progress in Production of Iodized Salt 1991 - 2002

Table 2: Qualitative Household Coverage with Iodized Salt 10-100ppm (1992 – 1999)

Table 3: Progress Impact of Total Goitre Prevalence (TGR) for selected Sentinel Sites (by palpation method)

Table 4: Impact on Urinary Iodine excretion levels 1990-1995.

Table 1. *Progress in Production of Iodized Salt 1991 - 2002*

Fiscal Year	Producer	Quantity (tons)	Total (tons)
1991-1992	SELCAM	41,000	41,000
1992-1993	SELCAM	46,975	46,975
1993-1994	SELCAM	50,105	50.105
1994-1995	SELCAM	41,944	
	Imported salt-Senegal (SSS)	4,300	
	Imported salt Via Geneva (PRADIS)	9,000	55,244
2001-2002	SELCAM	40,000	
	SOTRASEL	30,000	
	SOCAPURSEL	50,000	
	Imported	21,000	
	SOREPCO/SS		141,000

SSS: Sel de Sine Saloum from Koalack, Senegal
PRADIS: Salt from Geneva PRADIS Communities
+ Other brands from Nigeria and Europe are also present in small quantities.

Table 2. *Qualitative household coverage of salt of 10-100ppm (1992-1999)*

Year	Percentage Coverage
1992	62.5%
1993	65.80%
1994	82.70%
1995	89.50%
1998	95%
1999	96%-100%
2001	97%
2002	95.4%-98.5%

Table 3. *Progress impact on total goitre prevalence (TGR) for selected sentinel sites (by palpation method)*

Site	1990	1993	1995	1999	2002*
Foumban	65%		7.5%	5%	
Doukoula	75%		45.3%		
Oshie	64%	38.8%	21.1%	0%	
Mokolo	36.70%		2.8%		
Jakiri/Wvem	58.8%		18.22%		
Pitoa	30.5%		11.8%		
Vina (Sassa-Mbersi)	45%			7%	
Bangoua	36.77%		1.58%	6%	
Ndoungue	14.11%		3.22%		
Bertoua	14.4%			0%	
General Mean	29.4%		10.26%	5.80%	5.4%

(n=2481)

*(Note: 2002 National Survey used 30 Cluster Method-not corresponding to many sentinel sites)

Table 4. *Impact on Urinary Iodine Excretion in some sentinel sites 1990-1999*

Site	Year	Urinary Iodine Excretion
Batouri-Betare-Oya	1990/91	81.5µg/L (n=46)
	1993	24µg/L (N=47)
	1995	121.5µg/L-140µg/L
	1999	Bertoua 425µg/L (n=25)
Foumban	1990	-
	1993	84µg/L (n=41)
	1995	-
	1999	191µg/L (n=24)
Oshie	1990/91	67µg/L (n=60)
	1993	68µg/L (n=49)
	1995	104µg/L –129µg/L
	1999	418µg/L (n=26)
Jakiri/Wven	1990/01	37.6µg/L (n=76)
	1993	20µg/L (n=49)
	1995	-
	1999	291µg/L (n=22)
Vina/Sassa Mbersi	1990/91	45µg/L (n=87)
	1993	54µg/L (n=48)
	1995	-
	1999	77µg/L (n=24)
Bangoua	1999/91	-
	1993	49µg/L (n=48)
	1995	-
	1999	403µg/L (n=23)

(NB: Iodized salt with iodized oil injections were used in some health centres in Batouri/Betare/Oya before USI began in 1991/92).

Table 5. *Urinary Iodine Levels for ten sentinel sites – January 1999 and 30 Clusters by 2002.*

Province	Sentinel site	Median (1999)	Mean 2002
North West	1. Oshie	418µg/L	
	2. Djottin/Oku	291µg/L	
West	3. Bangoua	403µg/L	Thirty
	4. Foubam	191µg/L	
Littoral	5. Sakbayemi	283µg/L	Clusters
South West	6. Tiko	114µg/L	
	7.Akwaya	123µg/L	
South	8. Ebolowa	110µg/L	
Adamoua	9. Sassa Mbersi	77 µg/L	
East	10. Bertoua	425µg/L	
	TOTAL	**283µg/L**	**190µg/L**

2.2.5 IDD Survey of 1999

This evaluation took place in January 1999 in 7 out of 10 provinces due to problems of logistic support, and 10 Sentinel zones were studied. It was coordinated by the ICCIDD Regional Coordinator for Africa to confirm the evidence of virtual elimination of iodine deficiency found in two peripheral zones by the Seven African Country study conducted by WHO/ICCIDD in November 1995. The parameters studied were: Total Goitre Prevalence in school children 6–12 years, Urinary Iodine Excretion level and the presence of new cases of endemic cretinism. The TGR had dropped to less than 5% in 6 zones but we registered 6% for Bangoua, 7% for Sassa Mbersi, 8% for Sakbayemi and 11.9% for Djottin-Oku-the total averaging less than 5% since the TGR was 0% in 3 zones. No cases of Grade 2 (Visible Goitres) were seen–only palpable goitres.

The urinary iodine excretion median levels ranged from 77-425 µg/L, with a mean of Medians equal to 283µg/L which is above the optimal cut-off level indicating correction of Iodine Deficiency. **(Table 5)**. Thus it was concluded that Cameroon had now attained sustainable adequate iodine nutrition status, especially given the fact that two new Iodized Salt Producers had been established at the port-city of Douala, namely SOTRASEL, SOREPCO. In 2002, a third producer called SOCAPURSEL, with a giant ultra-modern plant, joined the salt market, thus strengthening our hope for the future of sustainable IDD elimination.

2.2.6 Results of 2002

Between the months of July and September 2002, the Ministry of Public Health conducted a national survey to evaluate the impact of the USI operating since 1991 and to confirm or refute the evidence of the January 1999 evaluation. They used the standard research methodology of 30 randomly selected clusters of the population recommended by WHO/UNICEF/ICCIDD in 2001. Only children 6-12 years were studied. Preliminary report findings were as follows:

- The Total Goitre Prevalence (obtained by palpation technique) was 5.4%
- The national median value of urinary iodine was 190 µg/L
- No new cretins have been born since 1991; the only one seen was born that year in a rural village in the Bafang outskirts
- The national coverage with iodized salt of 15ppm and above was 97% having been 81% in 1995; 95.6% in 1998; 95% in 1999 and 94% in 2002

Table 6. *Sustainability Measures Progress on Provisions for Sustainability*

Recommended Input	Impact
1. Government Political Will and Commitment	Present and sustained, Hence Impact Evaluation of 2002
2. Legislation on Program and Salt	Present and appropriately revised in 1995, 1996
3. National IDD Committee	Present and active
4. Salt Monitoring System.	Present and integrated in National Epidemiologic System at Health District level. Reports Yearly
5. Iodine Laboratories	· Yaounde Centre for Food Nutrition is part of IRLI Network, inter-calibrating with CDC Atlanta, etc · Centre Pasteur Laboratory is functional.
6. Internal Quality Control by Producers	SOCAPURSEL has a laboratory in the factory and also uses Rapid Test Kit. Other producers use Rapid Test Kits only.
7. Systematic Quality Assessment at Port of Entry	Vigilant mixed team of Health and Customs, and periodic control by Public Health Delegation
8. IEC on IDD control	· National Radio and Television is periodic · ICCIDD has published 30,000 booklets
9. Social Marketing of Iodized Salt	Producers carry out a lot of Advertising of their products by Bill Boards, T-shirts, package labelling, etc
10. National Coalition for IDD Elimination	Extension includes WHO, UNICEF, FAO, WFP, MPH, Faculty of Medicine, Ministry of Education, the Church, Scouts and others.
11. School Curricula and Nutrition Book	IDD control is already in School Textbooks.
12. Social Mobilisation	Periodic IDD and other Micronutrient Malnutrition Days take place around October periodically.
13. Capacity Building	Periodic Seminars in Health Ministry, Training of Laboratory Technicians.
14. Operational Research and Reporting	Cardiologists and Endocrinologists are compiling Statistics on Toxic goitres possibly Iodine-Induced Hyperthroidism; Medical Students work on IDD for MD Theses.
15. Participation of ICCIDD Focal Point	IDD Focal Point is Regional in ICCIDD Board Meetings for Update Coordinator for Central Africa 1987 –To date

- The total iodized salt production by Cameroon major Refineries (SELCAM, SOTRASEL and SOCAPURSEL) plus the imported salt from Senegal (Sel de Sine Saloum) and Nigeria (DICON and DANGOTE) far exceeds the national annual need of about 45,000 tons. Indeed these producers supply to the Sub-Regional Market which covers Cameroon, Tchad, Central African Republic, Congo (Brazzaville), Gabon, Equatorial Guinea, Islands of Sao Tome and Principé, and probably beyond.

The reliability of the above information stands to be generally acceptable for most indicators since external experts from the International Council for the Control of Iodine Disorders (ICCIDD) and Helen Keller International (HKI) were involved as consulting Scientific Advisers in the survey design and reporting, though some ecologic definitions are questionable. It is to be remembered that it was because many countries of the world had not yet attained "virtual IDD elimination" by the target year 2000, that the World Health General Assembly extended the date line to 2005. Thus Cameroon had already met the goal by 1999 and has since been involved with sustainability, which has so far, been quite successful.

2.2.7 Other Impacts

The national intellectual gains made by the improvement of the children's Intelligence Quotients (IQ) by 10-15 points and the quantitative and qualitative value gained by the **prevention of Brain Damage** for almost all the children now being born and yet unborn is obviously enormous. Indeed the quality of life of the present and future generations has been tremendously improved by this successful national IDD program.

Other inestimable impacts could be expected in the:

- decrease of the frequencies of spontaneous abortions:
- decrease in prenatal and neonatal, that is peri-natal mortality rates;
- decrease in still–birth rates;
- decrease in bizarre neurological disorders of children attributable to iodine deficiency;
- decrease in the proportions of underweight babies at birth; and
- decrease in the neo-natal hypothyroidism.

However, it has not been possible to demonstrate this improvement by the use of specific tests because these tests were not available.

We would expect an improvement in the educability of our children (other factors ignored) given their improved intelligence quotients. Also a decrease in school "drop–out" rates attributable to iodine deficiency and juvenile hypothyroidism.

In general, the socio-economic productivity of the nation is expected to improve and who doubts that the prowess of the Indomitable Lions (the Cameroon National Football team) during the last 12 years has not been at least partially attributable to adequate iodine nutrition assured by our successful national IDD program!

All along the Cameroon IDD program has cumulated several sustainability measures.

2.2.8 Merited Acknowledgements

For this remarkable and historic success, thanks are due to extensive Partnerships and Inter-Sectoral Collaboration, which in this instance include:

- Ministry of Public Health (MPH)
- World Health Organization (WHO)
- United Nations Children's Fund (UNICEF)
- International Council for Control of Iodine Deficiency Disorders (ICCIDD)
- Ministry of National Education
- Ministry of Industrial Development and Commerce (MINDIC)
- Faculty of Medicine and Biomedical Sciences of University of Yaounde I (FMBS) (formerly CUSS)
- National Centre for Research in Food and Nutrition (CNRAN)/IMPM and especially its iodine laboratory.
- Institut/ Centre Pasteur de Yaounde
- Centre for Hormone Analysis of IMPM/MINREST of Dr Manguelle Dicoum Biyong
- Helen Keller International (HKI)
- The Private salt producers (SELCAM, SOTRASEL, SOCAPURSEL) and major salt Importers (Soudanese, SOREPCO)
- The Committed IDD Focal Point- Prof. Daniel N. Lantum, Winner of ALGEPA AWARD in 1996 Paris.
- Ministry of National Education and Schools
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2.3

Nigeria

Dr. John Egbuta

2.3.1Summary and Lessons Learnt

- Advocacy and social mobilisation as a strategy has been effective in the effort to achieve USI in Nigeria. Not only did it succeed in enlisting the support of the major partners and stakeholders, it also enhanced the cordial relationship between the salt industries, government regulatory agencies and UNICEF.
- The legislation on Universal Salt Iodization (USI) was successfully passed at the early stages of the program in Nigeria. This singular act served as a catalyst for achieving the high coverage in the household consumption of iodized salt in Nigeria as far back as 1995.
- Capacity building through training and workshops helped to build bridges between the private sector, government agencies, and non-governmental agencies. This strategy contributed greatly to the success of the IDD elimination program in Nigeria. It was possible even for school children and housewives to develop simple skills to perform the testing of iodized salt in their homes using locally made soluble starch. Equipment and kits for regular measurements and continuous monitoring of salt were made available to regulatory agencies and relevant government ministries and parastatals.
- The media in general (electronic, print, and popular drama) was sufficiently well-informed about the sustained elimination of IDD and the promotion and monitoring of salt at the household level; to become strategic allies in the effort to bring about a behavioural change towards the control of IDD in the Nigerian population.
- It has become customary to celebrate the IDD week in the third week of October each year. This activity now features in the annual calendar of the Ministry of Health and is celebrated by the Ministry every year with little or no support from UNICEF or WHO.
- The commitment of key members of the National IDD Committee coupled with the sustained interest of the major agencies (UNICEF, WHO, and ICCIDD) has been and will continue to be very important to the IDD elimination program in Nigeria.

2.3.2 Introduction

The resolution to virtually eliminate Iodine Deficiency Disorders (IDD) by the year 2000 was made in 1990 on the strength of available evidence that iodine deficiency was a major cause of retardation in children and was one the contributing factors to high infant mortality (Hetzel 1983). Lack of iodine from conception is the most dramatic consequence of iodine lack with economic implications as pointed out elsewhere in this book (Levin 1987). Nigerians are beginning to understand that goitre, an enlargement of the thyroid gland is the result of a lack of iodine in the body. Many people believed that goitre resulted from witchcraft activities and in other communities a woman without goitre was not considered beautiful since the roundness of the neck was perceived as a mark of feminine beauty. However, the effects of iodine deficiency on brain development are not generally understood.

Awareness of IDD and its control through salt iodization was slow to arrive in Sub-Saharan Africa, and introduction of the program has been less than 10 years old. WHO, UNICEF and ICCIDD have been in the forefront for the eradication of IDD in Africa. Progress in the field started in 1985 with mobilization of WHO interest on IDD in Africa followed by the WHO/UNICEF/ICCIDD sponsored IDD Seminar in Yaounde Cameroon (Ekpechi (1987). Subsequent to this, were the appointment of an IDD Task Force for Africa, the appointment of 3 sub-regional coordinators and the creation of a Special Trust for IDD in Africa. In 1986 the Afro Committee in Bamako Mali sponsored by Cameroon and Nigeria adopted a similar resolution. The resolution urged WHO and UNICEF to take further active official action to promote control of IDD.

The entire landscape of Nigeria predisposes the country to iodine deficiency disorders because of its proximity to the Equator and the long months of rainfall spreading from April to November. The risk of IDD is quite high in Nigeria, a country that has a well demarcated goitre belt, where almost all the inhabitants within the belt live on cassava based food staple (Egbuta and Hettiaratchy 1996). At least 60 million Nigerians (from a total population of 140 million) are at risk of IDD. As early as 1965, Ekpechi had alerted the Federal Ministry of Health Nigeria on the IDD problem in the country and 1974 formed a Ministerial Committee on Iodization of Salt. This committee wound up in 1976 due to poor funding but again Ekpechi’s untiring advocacy resulted in the meeting of a Ministerial Expert Committee on IDD in Enugu in 1988. This committee recommended advocacy at all levels, setting up of a National Committee on Control of IDD. The committee again went into abeyance, due to administrative and funding problems.

The early studies of (Ekpechi 1967, 1973; Nwokolo and Ekpechi 1996) that IDD was a public health problem in Nigeria. More data were reported by Isichei, Das and Egbuta (1987) that led to the production of the first goitre map for Nigeria. The World Summit for Children in 1990 called for the virtual elimination of Iodine deficiency disorders (IDD) and in response to this call an IDD baseline study was carried out as a prelude to the introduction of universal salt iodization program (Egbuta 1993). This study was very extensive in scope covering all the 30 States of Nigeria with emphasis on the previously surveyed hyper-endemic Local Government Areas in 8 States of the country **(fig 1)**. The prevalence of IDD was established by the measurement of total goitre rate (TGR) but lacked the measurement of median urinary iodine in the surveyed populations. Following this study the total goitre rate for Nigeria was put at 20%.

The Standards Organization of Nigeria (SON) instituted mandatory iodization of salt in January 1994 and within 12 months it was possible for 95% of Nigerian households to have access to adequately iodized salt.

It has been 5 years since universal salt iodization started in Nigeria following a long period of advocacy with medium and high policy makers, regulatory agencies, and the salt industry. In those years, monitoring of salt in the industries and ports of entry by the National Agency for Food, Drug Administration and Control (NAFDAC) and the Standards Organization of Nigeria (SON), by titrimetric analysis, and at the household level by the Nutrition officers across the country, using the semi-quantitative rapid field test kits, has been fairly regular. The objective of the present review is to assess the impact of universal salt iodization in Nigeria in the last five years, and with reference to some of the sentinel sites studied previously during the 1995 multi-centre study.

2.3.3 Methodology and Results

In this study a total of 2372 school children in 11 Local Government Areas in 10 States were examined. The school children were distributed into 1420 males and 952 females (Onyenekwe et al 1999). School children aged between 8-12 years were used for the goitre survey and the estimation of urinary excretion of iodine (UEI). Goitres are easily detectable in this age group and the changes associated with improved iodine supply are more likely to occur earlier in them than adults. The method of goitre classification by palpation was employed using the new internationally accepted method in which the classifications are simply graded as 0,1, or 2. A total of 537 samples were analyzed for urinary excretion of iodine (UEI)

The multistage random sampling method was used as later described elsewhere (WHO/UNICEF/ICCIDD 2001).

Fig. 1 *Percent Prevalence of Endemic Goitre in Nigeria, by State, 1993*

Most significant in **Table 1** are the changes observed in Uzo-Uwani, Obudu and Okpokwu Local Government Areas (LGAs) where total goitre rates in each of the local government areas was above 60% in 1993. In each of these LGAs located in the Southeastern part of Nigeria, the rate of decrease over a period of five years is greater than 75%. The same rate of decrease is observed in Bakori, Anka, Gwarzo, and Bassa LGAs, all in Northern Nigeria. This assertion correlates very well with the measurement of urinary iodine excretion rates in these local government areas **(Table 2)**. All the subjects examined in Uzo-Uwani and Bassa had adequate urinary iodine excretion (above 10µg/dL). In Okpokwu, Obudu, Obanliku, Bakori, and Anka LGAs more than 70 % of the subjects had urinary iodine excretion more than the threshold value of 10µg/dL.

2.3.4 Discussions and Conclusions

The World Summit for Children (WSC) resolution was quite an ambitious one, declaring the year 2000 as a target for the virtual elimination of IDD globally. The IDD landscape in Nigeria has changed significantly between 1993 and 1998, using as indicators, total goitre rate measurement and urinary iodine excretion. The prevalence of goitre gives an idea of the past history of iodine nutrition at the population level. Palpation is the simplest method for measuring thyroid size. However palpation becomes imprecise as the majority of goitres in a population diminish in size, i.e., following implementation of a national salt iodization scheme. In this case measurement of thyroid volume is more accurately performed by ultrasound (Delange 1994)). Much of the recent IDD assessment work done in Europe was accomplished by ultrasonography transported across countries and borders by van (Delange et al 1995). In West Africa a similar exercise has just been concluded in Benin, Togo, Burkina Faso, and Niger.

It is not clear why the decrease in the goitre rates observed in Akoko-Edo, Ekiti East and Ifedapo LGAs are not as dramatic as the others observed in this study. These LGAs are located within the same geographical and cultural zone in Western Nigeria, which may imply the involvement of a common factor such as food pattern. The disparity in the dietary patterns of the various ecological zones in Nigeria could be responsible for the observed differential reduction rates between Western Nigeria and other parts of Nigeria. The progress towards elimination of IDD in the south eastern part of Nigeria is very remarkable particularly in Uzo Uwani Local Government Area where prevalence was 67% in 1993 but had fallen to 9.8% in 1998. The 1995 multi-centre study had put goitre prevalence in that LGA at 40%.

Table 1. *TGR for selected LGAS for 1993, 1995 and 1998*

Table 1 shows trend in the reduction of goitre rates over the years in schoolchildren, based on different surveys, in the previously hyper-endemic local government areas.

Location State	LGA	TGR		
		1993	**1995**	**1998**
Enugu	Uzo-Uwani	67	40	9.8
Cross River	Obudu/Obanliku	62	N/a	14.9
Benue	Okpokwu	60		9.4
Edo	Akoko-Edo	32	26	30.4
Ekiti	Ekiti East	38	N/a	33.3
Oyo	Saki (Ifedapo)	36	N/a	16.2
Katsina	Bakori	11	N/a	2.9
Kebbi	Anka	22	N/a	2.9
Kano	Gwarzo	13	N/a	4.1
Plateau	Bassa	26	N/a	4.7

Table 2. *Values of Urinary Excretion of Iodine (UEI)*

Shows the urinary excretion rates of iodine in the previously hyper-endemic local government areas as well as the selected non-IDD endemic local government areas such as Gwarzo and Bakori.

State	LGA	NO	Range (mg/dl)	Median (mg/dl)	MEAN (mg/dl)	SD
Enugu	Uzo-Uwani	46	10.6–20.0	15.65	15.72	2.75
Cross River	Obudu/ Obanleku	80	6.4–20.0	14.70	14.75	3.88
Benue	Okpokwu	94	1.0–19.8	14.80	14.03	4.75
Edo	Akoko-Edo	41	1.0–19.4	14.00	13.96	4.11
Ekiti	Ekiti East	42	5.8–19.8	14.60	13.56	3.81
Oyo	Saki (Ifedapo)	56	1.6–20.0	9.20	9.15	5.17
Katsina	Bakori	29	5.2–16.8	10.60	11.35	3.77
Kebbi	Anka	62	6.5–20.0	15.55	14.59	4.20
Kano	Gwarzo	37	3.0–20.0	12.60	11.45	5.08
Plateau	Bassa	50	10.0– 9.4	15.50	15.06	2.83
TOTAL		**537**	**1.0–20.0**	**14.65**	**13.39**	**4.04**

Also, it is not clear why the 1998 total goitre rate in Akokoedo LGA is as high as 30.4% after the level had been noted by an international team in 1995 to be 26% down from 32% in 1993. However, it should be noted TGR as a measure of IDD is fraught with unavoidable human errors and personal bias and, for this reason, is gradually becoming obsolete, particularly in the developed world.

Iodine deficiency is not the sole cause of endemic goitre. There are some goitrogenic factors in the diet or environment, other than iodine deficienty, may play a critical role in the aetiology of the disease (Gaitan 1989; Delange et al 1982). Natural goitrogens were first found in vegetables of the genus Brassica (Podoba and Langer 1964) (the Cruciferae family), which possesses goitrogenic properties in animals. Their antithyroid action is related to the presence of thioglucosides, which after digestion, release thiocyanate and isothiocyanate. Another important group of naturally occurring goitrogens is the cyanoglucosides, which have been found in several staples (cassava, maize, bamboo shoots, sweet potatoes, lima beans) (Ermans et al 1980; Langer andGreer 1977). After ingestion, these glucosides release cyanide, which is detoxified by conversion to thiocyanate, a powerful goitrogenic agent that inhibits thyroid iodide transport and, at higher doses, competes with iodide in organification processes (Ermans et al 1980). In Akokoedo and Ekiti-east LGAs which are contiguously located in western Nigeria the major food staple is cassava, a noted goitrogen whose presence in the diet could explain why the rate of decline in total goitre rate in those two LGAs located in Western Nigeria including Ifedapo, is not as sharp as those observed in the Eastern part of the country.

The use of urinary iodine excretion rates as a measure of IDD status provides a more vivid indication of the virtual elimination of IDD in previously endemic sites **(Table 2)**. A median urinary iodine excretion rate in excess of 10mg/dL in a given population is indicative of iodine sufficiency in that population. In all the LGAs, except one (Ifedapo, with 9.20µg/dL), assayed in this study the median excretion of urinary iodine exceeded 10µg/dL. Urinary iodine excretion measurements are indicative of the current dietary intake of iodine and, although the previous multi-centre study determined urinary iodine excretion rates in only Uzo-Uwani and Akokoedo, it is evident from this study that the populations in these LGAs were iodine-sufficient. The slightly low urinary iodine excretion rates in Ifedapo (Saki) and Gwarzo LGAs may be connected with the reported inundation of the areas with non-iodized industrial salt by some unscrupulous traders.

There is strong evidence emerging from the two urinary iodine studies in Nigeria that the country is generally iodine sufficient. As can be seen in **Table 2** the median urinary iodine excretion for the sampled population, drawn mostly from IDD-endemic areas is 146.5µg/L with a mean value of 133.9µg/L. If this picture holds true for the rest of the country, Nigeria would rank among the countries where the universal salt iodization scheme has achieved the desired impact. For the communities sampled the health and socio-economic burden of IDD has been lessened, which translates into improved child survival, improved educability, independence and productivity and improved earning power.

The regular and routine measurement of iodized salt using the field test kit over the last three years has consistently indicated the availability of adequately iodized salt to about 96% of Nigeria households. The survey conducted in 1998 showed that 98.7% of Nigerian households have access to adequately iodized salt at 30ppm. This finding would suggest that Nigeria, in general terms, has achieved the goal of Universal Salt Iodization (USI) and should now focus its attention on constant monitoring in order to sustain this level of iodization. Some of these data have been published elsewhere (Egbuta et al 2003).

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2.4

East and Southern Africa

Judith Rudo Mutamba

2.4.1 Introduction

Iodine deficiency is a major nutritional problem, which affects both the developed and developing countries. It is due to limited intake of iodine and in some cases exacerbated by goitrogens such as cassava. The presence of endemic goitre, enlargement of the thyroid gland reflects significant iodine deficiency in a population. Iodine deficiency affects all stages from foetal life to adulthood. Physical and mental development including intellectual capacity is impaired (Hetzel & Pandav 1994). Iodine deficiency disorders (IDD) are internationally a common cause of ill health. In Africa IDD exacerbates the burden of disease, which is heavier due to poverty and lack of access to basic social services as reflected by high infant, child and maternal mortality rates. Millions of children in East and Southern Africa die of preventable diseases and malnutrition. The dramatic effects and low cost of iodine prophylaxis makes elimination of IDD a key public health program to implement especially in Africa due to the expected high returns. Sustainable elimination of IDD will help reduce the infant and under-five mortality rate.

Iodine deficiency (ID) has been documented as a major public health problem in the East and Southern African countries since the early 1900's. National goitre surveys indicated prevalence ranging from 20% to above 60% in almost all the countries. Biochemical indicators of urine iodine (UI), thyroid stimulating hormone (TSH) and iodine in drinking water substantiated the severity of the ID. Policy makers in the sub-region did not immediately act to address the iodine deficiencies. The first recognition of IDD as a public health problem was in 1987 during the meeting jointly convened by WHO, UNICEF and the International Council on the Control of Iodine Deficiency Disorders (ICCIDD) in Yaounde, Cameroon. The impetus for the elimination of IDD was at the World Summit for Children when world leaders endorsed the goals of virtual elimination of IDD and that of vitamin A deficiency and the reduction of the prevalence of iron-deficiency anaemia in pregnant women by one third, by the year 2000. By the year 2000 many countries had made progress in tackling IDD through universal salt iodation (USI). More than 60% of households in Africa had access to iodized salt. Iodine nutrition status improved rapidly as reported at the WHO Intercountry workshop for National program managers (WHO/UNICEF/ICCIDD 1998).

IDD were of public health significance in all countries in East and Southern Africa i.e. Angola, Botswana, Eritrea, Ethiopia, Kenya, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Tanzania, Seychelles, South

Africa, Swaziland, Uganda, Zambia and Zimbabwe except in Mauritius and Seychelles. Cretinism, the worst condition, with irreparable brain damage, was reported in Angola and Tanzania.

The IDD situation was unique for each of the countries and so were the challenges faced in addressing the problem. A summary presentation of the IDD situation is given below. The experience and progress of each country has systematically advanced the cause of IDD elimination in the sub-region.

2.4.2 Summary of Country IDD Situations and Experiences

2.4.2.1Angola

Partial surveys conducted in 1994 indicated that total goitre rate was 50% in Hwambo and ranged from 67–73% in Vie. Cretinism was also recorded. Legislation on salt iodization was approved in 1996 requiring 60–100 parts per million (ppm) iodine at production level. By 1996, only 17% iodized salt coverage was reported (WHO 1998)**.**

2.4.2.2 Botswana

Goitre prevalence in 1989 was 17% and median urine iodine ranged from 68µg/L in Southwest to 310µg/L in the East (WHO 1998). Salt surveys in 1998 showed that 98% of households had iodated salt. Legislation was delayed pending discussions to lower the level of iodization.

As a salt net exporter Botswana plays a vital role in IDD elimination in the sub-region. In 1990 the ICCIDD/UNICEF/WHO Task Force on IDD in Africa, at the fourth meeting held in Dar-es-Salaam resolved to urge SUA PAN (Botswana Ash) to install facilities for salt iodation (WHO 1990) Botswana Ash (Pty) Ltd (Botash) started producing salt in 1991 (Stewart 2003) It iodated salt to meet regulatory requirements of individual countries **(Table 1)**.

Botswana iodates coarse and fine salt for human and animal consumption with potassium iodate. A pan mixture is used to ensure effective blending to lessen iodine variation in any given batch. Botash implements a quality management system and has the ISO 90001:2000 accreditation, which assures us that Botash complies fully with international quality management systems standards. An on-site laboratory maintains Quality Assurance (QA) prior to the dispatch of the product (Stewart 2003). Botash has made significant contributions to the measurable success in the elimination of IDD in Southern Africa.

Table 1. *Salt Iodation Customer Requirements*

Country	Potassium iodate as I
Botswana	30 – 90 ppm
Malawi	47 – 59 ppm
South Africa	40 – 60 ppm
Zambia	50 – 90 ppm
Zimbabwe	25 – 55 ppm
Namibia	50 – 80 ppm

Source: Botswana Ash (Pty) Ltd

2.4.2.3 Kenya

Goitre surveys conducted in Mombasa, Nairobi and the Rift Valley between 1962 and 1964, indicated total goitre rate of 15–74 % with highest prevalence in the west of the Rift Valley in central Nyanza and in Western province (WHO 1997).

Kenya started the IDD control in 1970. Kenya is a major salt producer with 85% of the salt coming from the sea and the lakes. There are many salt manufacturers but 83% of all salt comes from only five manufacturers in Malindi and Mombasa. One company provides 70% of the salt consumed in the country. Salt iodation was enacted in 1970 at 20 ppm modified in 1973, 1978 and 1990 to 30 ppm and finally to 100 ppm. The Task Force for the Prevention and Control of Iodine Deficiency Disorders in Africa recommended the modification to 100ppm (WHO 1990). The high levels were to cover for anticipated iodine losses during transportation and storage.

A national Micronutrient Survey conducted in 1994 in 45 districts showed goitre prevalence of 16.3% and urinary iodine excretion of 62µg/L in children 8–10 years indicating improved iodine nutrition status (WHO 1998). A follow up study in 1995 in Kericho and Kiambu districts and Nairobi, showed lowered goitre prevalence of 10%. Iodine contents of samples analyzed in 1995 averaged 60 ppm at household levels. Median urinary iodine concentration ranged from 12.5µg/dL to 58µg/dL. Excessive iodation by some companies was noted**.** (WHO 1998).

Monitoring surveys indicated more than 90% iodized salt coverage by 2000. This success was mainly through collaboration between the salt industry, other business groups, the government, the scientific groups, development partners and the communities in all regions. Advocacy campaigns on USI were considered key in the program. October each year has been observed as the Micronutrients Month. IDD Days have been observed. The Scouts Association of Kenya assisted by the Kenya Salt Manufacturers, Ministry of Health, Kenya Bureau of Standards and members of the National Council on Micronutrient Control take an active role in sensitizing communities on IDD. The Scouts participate to ensure sustainable elimination of IDD in Kenya working closely with school children (Personal communication, UNICEF Nairobi 2002)**.**

2.4.2.4 Lesotho

A 1968 national study indicated total goitre rate of 41% and visible goitre rate of 14% in school children aged 6-13years. A second national study confirmed iodine deficiency in Lesotho. Total goitre rate was 42% in women of child- bearing age and 21% in school children, 6 to 13 years. The median urinary iodine concentration in mountains and lowland were 35µg/L and 55µg/L respectively (WHO 1998[a]). A 1993 national micronutrient survey revealed TGR of 42.5% and VGR of 15.3% in children between 6 and 16 years (Jooste 1997)**.**

Iodized oil capsules were distributed from 1995 to 1998. Legislation on universal salt iodation was promulgated in March 2000 at 40-60ppm (WHO 1998 b). Awareness campaigns were arranged through community gatherings, media, local newspapers, posters and pamphlets. An IDD Control Task Force was formed to ensure enforcement of legislation. In 1999 a qualitative study indicated 81.8% use of adequately iodized salt. Only 5.25% used non-iodized salt.

A recent study (Sebotsa, 2003) showed median urinary excretion of 214.7µg/L in children. The median urinary iodine concentration was higher in the Lowlands (329.9µg/L) than in the Mountains (182.6µg/L). Prevalence of goitre in children was 10.7% and 19.4% in women. Household coverage of iodized salt was 98.4% and 86.9% households used adequately iodized salt. The study revealed that IDD had been eliminated but effective regular monitoring of salt iodine levels was needed at point of entry.

2.4.2.5 Mauritius

In a national survey conducted in 1995, 10% of children between 3–6 years had urine iodine <50µg/L. However, 95.6% adults had urine iodine levels >100µg/L and 80.8% of pregnant women had urine iodine levels more than 100µg/L (WHO 1998b). The findings indicated no IDD and hence the strategy used is to get iodine from the diet.

2.4.2.6 Mozambique

Isolated small surveys conducted in 1989 and 1992 in Niassa demonstrated that TGR was 76% and VGR was 13.5%, Median urine iodine concentration (MUIC) was 28µg/L. Forty-nine percent (49%) of the urine samples had iodine concentration <20µg/L. In Tete province TGR was observed to be 50%. In a follow up survey in Niassa in 1995 TGR was 71%, VGR was 0.9%. In Cabo Delgado TGR was 35% and MUIC was 29µg/L. Manica province had TGR of 18% and urine iodine of 51µg/L. Gaza had TGR 8.1% and MUIC of 74µg/L. In Maputo TGR was at 9.4% and MUIC was 104µg/L (WHO 1998b). Though salt iodization program was inducted in 1995, it has not been legislated yet.

In 1999 of 53 registered salt producers, 41% did not have iodization plants. Twelve iodization plants installed with UNICEF funds, could only meet 70% of production capacity. A 1998 salt survey indicated iodization in: Maputo, 41%, Gaza, 26%, Manica, 51%, and Cabo Delgado, 28%. In November 1998 iodized salt household coverage was 39% as submitted by school children (WHO 1998b).

The salt producers need support to enable them iodate their salt. A monitoring system should be developed and the laboratory strengthened to enable urine iodine analysis.

2.4.2.7 Namibia

In the 1990-91 survey in the Caprivi region, in school children 6–18 years, TGR was 35% in boys and 38% in girls. In the 1992 national survey of 1830 children aged 8-12yrs TGR ranged from 0–7%, UI=77-137 µg/L in South and central areas. In the North, TGR was 15–25% UI was 46µg/L and in the Caprivi TGR was 55% and UI = 25µg/L. National TGR was 24% and urine iodine levels were 53µg/L (WHO 1998a). In sentinel surveillance in 1994, TGR was 14% and urine iodine levels were 113µg/L. The 2000 country update indicated the level of salt iodation ranging from 0–80ppm. Ninety percent of households consumed iodized salt. Total goitre prevalence has gone down to ranges of 0-20% and urinary iodine levels raised to 216.3µg/L. Virtual elimination of IDD is expected to be soon.

2.4.2.8 South Africa

Endemic goitre was reported in South Africa in 1927. A goitre research committee appointed in 1948 recommended iodized salt to all endemic goitre areas in South Africa, the Caprivi Strip and Swaziland. Voluntary iodization of salt was introduced in 1954 at 10 to 20 parts per million (ppm) to prevent and control the endemic (Jooste 2000).

A 1955 survey identified goitre endemic areas from East Cape to Eastern Transvaal including Lesotho and Swaziland. Isolated studies conducted in 1994 and 1995 confirmed the endemic. A survey conducted in Cape Province found TGR of 26% and median urinary iodine level of 22 µg/L.

Whilst there were no national data on the IDD situation in South Africa, direct and indirect evidence suggested that IDD was endemic in some regions in the country. On that weight an Iodine Deficiency Disorders Control Program Committee was formed with members from the public sector, industry, consumer groups and UNICEF. It advocated for compulsory salt iodation from December 1995. The legislation increased the iodine level from 10–20mg/kg to 40–60mg/kg (Jooste 2000).

In 1998 the South African Institute for Medical Research conducted a national survey, which confirmed that South Africa had a national IDD problem. Goitre rate was 40.9% in 2377 boys and girls of 7–11 years. Iodized salt coverage increased from 30% to 62% in two years after the introduction of mandatory iodization. The mean household salt iodine concentration was 27mg/kg. The median iodine concentration ranged from 6mg/kg to 42mg/kg. The national median was 30mg/kg. The study indicated that 13.6% of households used non-iodated salt, 21.1% inadequately iodized, and 1.8% households used salt with excess iodine. Nationally 62.4% households used adequately iodized salt (Jooste 2001).

Urine iodine survey of 8524 urine samples from 179 schools in the 9 provinces indicated median urine iodine of 177µg/L (range 156–259µg/L) mean range from 172-250µg/L **(**SAIMR 2000). Just under 90% of schools had on average an adequate iodine intake whilst 10.6% of sample had median urinary iodine concentration of less than 100 microgram, indicating a degree of dietary iodine deficiency.

South Africa made major progress in the elimination of IDD through USI in only seven years. Virtual and sustainable elimination of iodine deficiency in South Africa is assured.

The key elements to the South African achievements include the following:

- Dedication of a core group of individuals.
- The establishment of the South African IDD network or National Coalition.
- Monitoring and surveillance of the IDD Control Program on both process and impact indicators.

Major concerns raised were:

- Salt for agriculture is not iodated and this leaks into human consumption. Livestock iodine nutrition status remains un-addressed.
- Salt is not available in households of the very poor in some of the rural areas.

2.4.2.9 Swaziland

In a survey of school children in four endemic areas (1993) TGR ranged from 6–38%, median urine iodine concentration ranged from 12–35µg/L. Legislation if USI was in 1997. In a follow up survey in 1998 TGR reduced from a range of 1.6 – 11% and median urine iodine concentration ranged from 101–234µg/L (WHO 1998b).

In the 2000 Multiple Indicator Cluster Survey, 5.8% population had no salt, with the poorest being the most affected (8%). Only 54% of households had adequately iodized salt. More households in rural areas (44.1%) had inadequate iodine salt levels compared with those in the urban areas (34.2%) (Jooste 2000). Swaziland was far from eliminating IDD. Since it imports all its salt Swaziland needs to enforce legislation on USI and import only iodized salt.

2.4.2.10 Tanzania

Iodine deficiency disorders were noted in Tanzania in 1923. Surveys conducted in 1953, 1958 and 1963 showed goitre prevalence of 75.8 percent. Despite the high levels intervention was not instituted due to uncertainties on dealing with non-goitre areas. There were fears of toxicity since hyperthyroidism had been reported.

The Tanzania Food and Nutrition Centre (TFNC) conducted goitre surveys in 20 regions between 1980 and 1998 with financial support from the Swedish International Development Agency (SIDA). It was estimated that 5.61 million people had IDD, 160 000 were cretins and 450 000 cretinoids. Many areas were identified to be highly endemic with total TGR above 60 percent. Mbeya and Mbozi districts had TGR above 80 percent (WHO 1998b).

In 1985, the National Council for the Control of Iodine Deficiency Disorders (NCCIDD), a multi-sectoral policy body was mandated to co-ordinate the implementation of the IDD Control Program.

Iodized oil was administered to everybody aged 1–45 years in 27 severely IDD affected districts. By 1999 Tanzania had distributed a total of 16.1 million capsules to more than 6.0 million people. The short-term intervention was mainly financed by SIDA, Japanese International Co-operation Agency (JICA) and UNICEF.

Tanzania has a complex salt iodation program. It is a net producer of salt and has large, medium and small-scale salt producers, a situation similar to Angola, Eritrea and Mozambique. Small-scale salt producers are a challenge in implementing universal salt iodation.

The Tanzania Salt Iodation program started in 1988 with support from the Netherlands Government, UNICEF and the International Labour Organisation. There were 197 registered large and medium-scale salt producers with salt production capacity of 267,000 metric tonnes (MT) per annum. The national demand for salt was only 96,000 MT, which meant Tanzania could meet all its salt needs.

Eight iodation machines with mixers were procured and installed. A total of 106,000 metric tonnes of iodated salt per year was expected with machines fully operational. By December 1995, 46 salt iodation machines had been procured and distributed to sites in Kigoma, Tanga, Coast, Dar-es-Salam, Mtwara, Lindi and Dodoma regions. UNICEF supplied an additional 25 small machines for small-scale salt producers.

By 1997, a total of 72 iodation machines had been procured including accessory equipment. Potassium iodate, test kits and packaging materials were also supplied free of charge. Training of salt producers on quality control, storage and handling of iodated salt was provided with installation of iodation machines.

The salt iodation regulations were instituted as early as 1978 but implementation only started in January 1995. Iodation at factory level was set at 75–100 parts per million.

The Tanzania Salt Producers Association (TSPA) was set up in 1994 supported by government to coordinate all the country's salt producers. The association is involved in conducting training and distribution of requirements for salt iodation.

i) IDD Status

Surveys carried out in Tanzania mainland, showed that goitre prevalence had decreased from 67.6 percent (in 1980s) to 23.5 percent (in 1999). Visible goitre rate was 6.3 percent. Median urine iodine concentration (UIC) was 235µg/L (N=2089). Only 9.1 percent individuals had UIC below 50µg/L.

Iodated salt coverage at household level was 83.3 percent {range 52.9–97.2 percent (N=21 1153)}. Non-iodated salt came mainly from small-scale salt producers. Awareness of the IDD problem and its control was poor among the general public and community participation in the program was low.

In the 27 endemic districts, salt iodine content varied. A few samples exceeded 100ppm. A 56 percent population had urine iodine concentration above 200µg/L. A reduction of iodization levels from 75–100 parts per million (ppm) to 50–70 ppm was recommended.

The Islands of Zanzibar are part of Tanzania. A situation analysis carried out in March/April 2001 revealed that IDD exists in Zanzibar and worse in Pemba Island **(Table 2)**.

ii) Small-Scale Salt producers

A study conducted in 2002/2003 on Small-scale Salt Producers identified 4 461 in Tanzania (TFNC 2003). Almost half (49.2 percent) of the producers had never iodated their salt mainly due to lack of awareness of the salt regulations. Producers did not know where to get potassium iodate and had no knowledge and skills on salt production and iodation.

This study highlighted priority areas to be considered for assistance to small-scale salt producers if virtually elimination of IDD is to be achieved.

2.4.2.11 Uganda

IDD was reported as early as the 1960's. In 1991 a survey carried out in nine districts amongst school children 6–12 years, reported overall TGR of 74%. A few cases of cretinism were reported in Kabale villages. In 1999 IDD monitoring survey was conducted in six districts among 2860 schoolchildren. The overall TRG had dropped to 16% and overall median iodine concentration was above 100µg/L and only 5% had a median concentration below 50ug/l. Sixty four percent of salt samples had iodine levels above 50ppm. The remarkable improvement in IDD was attributed to enforcement of the legislation on salt iodation at 100ppm (Bachou 2000).

2.4.2.12 Zambia

A 1971 national prevalence survey of the general population in 37 districts showed TGR of 50.5% and VGR of 13%. A National IDD Task Force was formed in 1990. A National baseline survey conducted in 1993 showed TGR of 31.6% and mean UI excretion of 60µg/L. The 1996 Multicentre Study showed decreases in TGR since 1993: Livingstone, 82% to 4.3%; Choma, 59% to 16% and Katete, 31% to 4% (WHO 1998b).

Most salt comes from Botswana and Namibia. Legislation on salt iodation was enacted in 1978 and revised in July 1994 requiring salt iodation of 80–00ppm at factory level, 50-80ppm at point of entry and 30-50ppm at retail level. In 1999, households ranging from 37% to 93% had adequately iodized salt.

A 2002 survey indicated TGR of 31.8% in pupils from 25 schools. Median urinary iodine concentration (MUIC) was 246.5µg/L. Only 4% of the pupils were in the range of 50–100µg/L, 20% were between 100–200µg/L and 76% between 200–500µg/L. The results showed that 93.5% of the salt had adequate iodine and 85% households had access to iodated salt (Zambia National Food & Nutrition Commission, 2002). The survey indicated that Zambia had eliminated IDD.

The need for databases for recording urine, salt and goitre results was articulated. There was also a recommendation to revisit the salt legislation to lower the iodine levels and include iodated salt for animal consumption.

2.4.2.13 Zimbabwe

Surveys conducted between 1968 and 1988 established the prevalence of IDD. The Ministry of Health with support from the Swedish International Development Agency and UNICEF conducted a national goitre survey in August 1988 amongst 164,096 primary school children in 53 districts. The survey indicated TGR ranging from 10.8% in the capital city Harare to 78.7% in Murehwa district. More than a third of the districts had TGR above 50%. The national TGR was 44% and VGR was 4% (Mutamba 1993). The survey revealed that Zimbabwe was at risk of IDD. The severity of the endemia was confirmed by urinary iodine levels, which ranged from 14–24µg/L (Mutamba 1993).

An intersectoral committee established in 1989 developed a plan of action to address IDD. Iodized oil capsules were distributed in Murewa district. By 1992 iodized salt was available throughout Zimbabwe. The 1973 Food regulations were amended in 1994 making salt iodation mandatory at 30–90ppm.

Before 1993 little iodized salt was available. By 1993 significant iodized salt was available countrywide and by late 1994 the median salt iodine levels were below 30mg/kg. By 1998 the median had reached 60mg/kg. Assays were conducted at the Government Analyst Laboratory and at the University of Zimbabwe. A monitoring program was established. Urine iodine in schoolchildren and household salt iodine levels were recorded from established sentinel sites. Salt collected countrywide was analyzed for iodine by titration. The results of the salt monitoring revealed great variability in iodine levels. In 1997 salt data found that 31% of samples had iodine levels outside the permitted range. This variability explained the wide variability in urinary iodine levels. Some individuals had values in excess of 1200µg/L. Between 1991 and 1995, UI levels increased more than ten fold.

In 1995 the overall median UI from 6 districts was 430µg/L (range of medians: 290-560µg/L) and mean 490µg/L. Of 966 samples analyzed 16 (1.7%) had values below 50µg/L and 48 (5.0%) below 10µg/L. In 1998, median UI rose to 417µg/L in 11 districts. In Nkayi and Shurugwi districts the median urine iodine levels were well above 600µg/L. The high levels of iodine was reason of concern. Whilst most people had no difficulty in dealing with high iodine intakes, some susceptible individuals developed hyperthyroidism (Todd et al 1995, 2000).

Zimbabwe faced the challenge of iodine-induced hyperthyroidism (IIH), which increased three-fold. IIH occurred due to the rapid improvement of iodine status in a population, which had been severely deficient. This transient IIH was observed in other countries in association with iodine excess where there had been severe iodine deficiency (WHO/UNICEF/ ICCIDD 1997). It is important that clinical facilities are available for diagnosis and treatment of these patients. They are usually over the age of 40 so that radioactive iodine is the treatment of choice (Section IV).

In Zimbabwe the problem was identified and quickly addressed because of an established monitoring system. This led to a recommendation of reduction of iodation levels to 25-55ppm in 1999. Despite all hurdles, universal salt iodization has been a great success in Zimbabwe (Todd et al 2000).

The 1999 National Micronutrient survey indicated median UI concentration of 245µg/L, which was above the recommended 100-200µg/L. Only 5% samples were below 50µg/L. More than 97% households were consuming iodized salt.

2.4.3 Discussion

East and Southern Africa had a major public health problem of iodine deficiency as reflected by goitre levels, which ranged up to 60% or more in some areas. The severity of the endemic was verified by more than half of the populations in the various countries showing urine iodine levels below 50µg/L. Even though the goal of eliminating iodine deficiency disorders by the year 2000 was not met the East and Southern African countries made major strides towards the elimination of the scourge as reflected by the process and impact indicators. Most countries passed legislation on salt iodation and through universal salt iodization, East and Southern Africa have made good progress towards the elimination of IDD. Most countries have however been observing high urine iodine levels indicating high levels of salt iodation. The excessively high iodine levels led to IIH in Zimbabwe. These can be addressed by careful monitoring of salt and urine iodine levels to avoid excess intake (WHO/UNICEF/ICCIDD 1997).

Through national and sub-regional support with collaboration from bilateral, international agencies and non-governmental organizations capacity was built within countries to deal with IDD. Courses offered under the PEG program, PAMM, ICCIDD and by TFNC created in-country core teams with interest and expertise to deal with IDD.

Harmonisation of Iodized Salt Regulations for the Countries in Southern Africa is proceeding (Nyamandi & Mutamba 2000).

Technical and financial support from international program implementation has led to the development of iodine laboratories to deal with the in-country analyses. Recently the designation of South Africa as part of the International Resource Laboratories for Iodine (IRLI) Network will assist in sustained country program monitoring. The IRLI Network was formed to strengthen the basic monitoring component of universal salt iodization worldwide.

Challenges for the next decade in the sub-region include the following:

- Facilitation of small-scale producers to enable production and supply of quality iodated salt.
- Mainstreaming training on IDD to enable continuation of expertise in the area since the experienced old group might fade away.
- Need to form active National Coalitions inclusive of all disciplines, with the salt industry taking a central role.
- Strengthen the monitoring and evaluation system to avoid pitfalls where non-iodized salt continues to be delivered or where excess iodine is supplied leading to IIH.
- Legislation for iodization of salt for animal consumption should be adopted.
- Applying some of the successes of the program to address other micronutrient deficiencies.

These challenges can be met with continued advocacy and monitoring with allocation of resources.

2.4.4 Conclusion

In conclusion major steps have been made in the last decade to eliminate IDD in East and Southern Africa through Universal Salt Iodization. Momentum should be maintained through continued monitoring, to address the remaining challenges, to ensure virtual and sustainable IDD elimination in all countries then maintain the iodine nutrition.

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3

South-East Asian Region

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3.1 Lessons Learnt

3.2 Tracking Progress in the Region

3.3 India

3.1

Summary and Lessons Learnt

Iodine Deficiency Disorders (IDD) have been a major public health problem in all the 10 countries in the WHO-South East Asia Region (WHO-SEAR). It is estimated that a total of 599 million people from this region alone are affected by IDD, thereby constituting the highest number of population from a single region.

The proportion of households consuming adequately iodized salt varies between 1.7% in DPR Korea and 8% in Maldives to 75% in Thailand and 82% in Bhutan. While in the remaining countries it varies from 50% to 65%. An external evaluation was co-ordinated by the Global Network for Sustainable elimination of iodine deficiency in 2002 which confirmed elimination of IDD in Bhutan.

Efforts are in place to increase the availability of adequately iodized salt at the household level, and most importantly to sustain the coverage over 90% and to introduce a system of cyclic monitoring using IDD indicators.

3.2

Tracking Progress in the Region

Iodine Deficiency Disorders (IDD) have been a major public health problem in all the 10 countries in the WHO-South East Asia Region (WHO-SEAR). It is estimated that a total of 599 million people from this region alone are affected by IDD, thereby constituting the highest number of population from a single region (WHO 2002). A summary of IDD prevalence and progress in its elimination in the countries from this region is presented in **Tables 1**, **2 and 3.**

Bangladesh has reduced IDD with a fall in the Total Goitre Rate (TGR) from 47.1% in 1993 (Dhaka University/ICCIDD/UNICEF 1993) to 17.8 % in 1999 (Salamatullah 2001). In Bhutan, it has been reduced to 14% in 1996 (ICCIDD/UNICEF/MI 1996) from 60% in 1983 (AIIMS/UNICEF/WHO 1983). Bangladesh and Bhutan have achieved near universal supply of iodized salt, but they have not been able to achieve universal availability of iodized salt at the household level due to various reasons. In April

Table 1. *Status of Prevalence of IDD in the WHO-SEAR Countries*

WHO SEAR Country	Year	Total Goitre Rate %	Urinary Iodine Median µg/L %	Urinary Iodine <100 µg/L %	Endemic Cretinism Prevalence %
Bangladesh	1999	17.8	Hilly Zone 63.8 Flood-prone -139.3 Plane Zone 147.7	43.1	0.4
Bhutan	1996	14	230	24	0.4– 0.9
India Kerala State	2000	16.6	123.3	32.5	**
Indonesia	1998	9	**	**	**
Maldives	1995	23.6	67	65.5	**
Myanmar	1997	28	**	**	**
Nepal	1998	Children-50 Women-40	Children-143.8 Women-114.1	35.1 43.6	0.4
Sri Lanka	2001	20.9	145.3	30.6	**
Thailand	1998	2.6	153	23	**

** Information awaited/No data available

Table 2. *IDD Elimination Strategies in the WHO-SEAR Countries*

WHO SEAR Country	Current Intervention Strategy	Legislation Status
Bangladesh	USI	Legislation In place
Bhutan	USI	Legislation in place
India	USI	Legislation in place at State Levels
Indonesia	USI Iodized Oil	Legislation in place
Maldives	USI	Legislation Awaited
Myanmar	USI, Iodized Oil capusle	Legislation Awaited
Nepal	USI, Iodized Oil capsule	Legislation Awaited
Sri Lanka	USI	Legislation in place
Thailand	USI, Iodized Oil capsule & Water	Legislation in place

Table 3. *Status of IDD Elimination Programs in the WHO-SEAR Countries*

WHO SEAR Country	Recommended iodine content in salt (PPM)		Production / availability of iodized salt (proportion to the total requirements	Proportion of households consuming adequately iodized salt
	P= production	C= Consumer		
Bangladesh	50	15	99.7% (1999)	57% (1999)
Bhutan	60	15 – 25	100% (1996)	82% (1996)
DPR Korea	**	**	**	1.7% (2000)
India	30	15	92% (2000)	71% (1998)
Indonesia	30 – 80	30	59% (1998)	65% (1998)
Maldives	Yet to be decided		**	8%
Myanmar	40-60	25	66% (1997)	50%-60% (1997)
Nepal	50	15	91% (2000)	63% (2000)
Sri Lanka	50	25	63% (2001)	49.5% (2001)
Thailand	50	30	75% (1998)	75% (1998)

** Informaiton awaited

1958, Bhutan begun Annual Cyclic monitoring in addition to regular monitoring system. As a result, Bhutan now has a total goitre rate less than 5% median urinary iodine 298 µg/L and iodized salt coverage of 95% More recently an external evaluation was co-ordinated by the Global Network for Sustainable elimination of iodine deficiency in 2002 which confirmed elimination of IDD in Bhutan. Details of success stay of Bhutan are covered in Section VII The National Program for the Elimination of IDD Indonesia has a low TGR (9%), a significant improvement since 1993 when the goitre prevalence was 27.3% (WHO 1997). The prevalence of IDD is reduced from 9.3% in 1989 (WHO 1997) to 2.6% in 1998 (EAPRO/ROSA/MI 1999) in Thailand, and it continues to show further reduction in the TGR. Thailand also introduced Annual Cyclic Monitoring. Currently (April, 2004) external evaluation co-ordinated by the Global Network for Sustaniable Elimination of Iodine Deficiency is in progress in Thailand. Sri Lanka (TGR 20.9%) now plans to monitor salt and urine iodine levels in all districts at least once in three years. All these countries have adopted Universal Salt Iodization (USI) through legislation to combat IDD.

There has been significant progress towards the control of IDD in Nepal. The median urinary iodine excretion (UIE) values were 114.1µg/L among women and 143.8µg/L among school-aged children, indicating that at national median UIE is just above the WHO cut-off point for a significant public health problem. The proportion of low UIE values (<100µg/L) has declined from 52% (general population) in 1985 to 39.1% (adult women and school-aged children) in the current survey. The prevalence of low UIE is highest among women and children living in rural areas and in the Terai zone. High prevalence in this region is reported from Nepal where goitre prevalence ranges from 40% to 50%. The virtual absence of visible goitre among the population, 1.3% among women and 0% among school-aged children, in the survey is also an indication of success. However, in spite of the improved UIE status, high rates of palpable goitre were seen, which may reflect past goitre rather than current iodine deficiency. The finding that most of the salt samples tested contained some iodine (82.8%) indicates that efforts towards the universal iodization of salt in Nepal is on track, and confirms the feasibility of universal salt iodization as the sole strategy for the elimination of IDD. Maldives (TGR 24%) has stepped up efforts to eliminate IDD through the “Maldives National Nutrition Strategy, 2001”. Myanmar (TGR 28%) has started with the monitoring of salt and urinary iodine status. However, in all these three countries, i.e. Nepal, Maldives and Myanmar, the USI legislation is still awaited. There is insufficient data on the prevalence of

IDD and its elimination efforts from DPR Korea. India, being a vast country with hyper endemic pockets, IDD prevalence shows a wide range from 2.3% to 68% based on country- wide surveys, and from different States and Union Territories (WHO 1997). A recent household based study from the Kerala state covering school age children showed 16.6% goitre prevalence. Similar studies are being undertaken in the states of Tamil Nadu, Orissa, Goa and Bihar. In India, the Central Government has lifted the ban status in September 2000. However, the legislation is in place in the state level and union territories. The details are covered in (3.3) India.

It is to be noted that 70% of households (average) consume adequately iodized salt (WHO/UNICEF/ICCIDD 1999). Universal Salt Iodization (USI) legislation is also in place in 6 countries in this region. Salt monitoring for iodine content is done in 8 countries on a regular basis, while 7 countries monitor urinary iodine status (ICCIDD/WHO/ UNICEF 2001). With one-sixth of the world population residing in this region, all these are laudable achievements.

Efforts are in place to increase the availability of adequately iodized salt at the household level, and most importantly to sustain the coverage over 90% and to introduce a system of cyclic monitoring using IDD indicators. The concept of cyclic monitoring has basically evolved as in most developing countries the evaluation of IDD control program is done countrywide once in 4 to 5 years either by national or International team. Thus there is no scope to know any pitfalls or midterm corrections in the control program. The cyclic monitoring concept envisages division of the country or area with IDD into five zones. Each year one district or area should be chosen for evaluation of IDD control program. The evaluation should be carried out using 30 cluster sampling technique (proportionate to size) from each cluster 40 children age group 6-11 should be examined for goitre grading and out of these 40 children, 10 urine samples and 10 salt samples should be collected on random basis. Thus, from 30 clusters, total of 1200 children should be examined for goitre grading, 300 urine and salt samples for analysis of iodine need to be done. In the second year another 5 districts or areas should be covered. Thus in 5 years the whole country will be covered and then the cycle can be repeated.

The advantages of cyclic monitoring are:

1) every year information on IDD will be available. Thus will help in knowing pit falls in the program so that current action can be taken
2) children aged 6 to 11 years are examined for goitre grading, In the next cycle the children examined would be from the next generation and hence the IDD control effect on the next generation would be visible.

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 iodization of edible salt by the end of 1995. Too many of us may diminish our efforts when we reach the plateau. The long climb to eliminate the stealthy scourge of IDD from the globe begins with the achievement of universal iodization of salt (Pandav 1995).

Basil Hetzel, in his inaugural address at the South Asian Country meeting on "Partnership to 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.

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3.3

India

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3.3.1 Summary and Lessons Learnt

An analysis of iodine deficiency disorders (IDD) elimination programs all over the world show that four elements contribute to their success political commitment, administrative infrastructure, scientific leadership and monitoring and evaluation. India's experience with the four essential elements can be summed up as follows:

i) Political commitment

For the first 20 years of its existence, the National Goitre Control Program (NCGP), launched in 1962 - iodized salt was a low priority renamed as the National Iodine Deficiency Disorders Control Program (NIDDCP). The turning point was in 1983, when Prime Minister Indira Gandhi was briefed by top scientists on the consequences of IDD and the availability of a cheap and cost effective solution. She decided that this was not only a health problem but a national development problem. Almost overnight, the program underwent a sea change and the strategy of Universal Salt Iodization (USI) was adopted. Goitre control was on the Prime Minister's 20 Point Program and the private sector was invited to produce iodized salt. In June, 1992 the NGCP was renamed as the Political Commitment also ensured adequate resource allocation. Interaction with the Prime Minister raised resource allocation to Rs 200 million in the Seventh Five-year Plan. (NIDDCP) in recognization of teh spectrum of disroders due to iodine deficiency Members of the ICCIDD have helped to make the authorities aware on a regular basis of the need for iodization.

ii) Administrative infrastructure

For proper administration, it is essential to have a nodal point for the program. For India this is the Adviser (Nutrition) and Deputy Assistant Director General (Goitre). Each state also has an IDD cell to act as its nodal point.

iii) Scientific leadership

ICCIDD members have been involved in conducting research on different aspects of IDD for the last 40 years. The formation of an NGO in India as the National Chapter of ICCIDD has facilitated the creation of a 'home base' located in the country's premier health institute, the All India Institute of Medical Sciences. This serves as the training and resource centre for field surveys, training in measuring iodine levels in salt and urine (to track progress towards IDD elimination), information dissemination, technical expertise and monitoring and evaluation of activities. State level workshops for IDD workers have been conducted from time to time to review progress, identify bottlenecks, learn from their own and others' experience and modify programs accordingly.

iv) Monitoring and evaluation

India has a system in which food inspectors collect salt samples and send them to laboratories for analysis. In New Delhi, ICCIDD has established a system for regularly enlisting the schools in monitoring the program:

ICCIDD has also forged collaborative partnerships with a network of NGOs such as the Voluntary Health Association of India and the Bharat Scouts and Guides, which carry out activities all over the country. In addition to providing technical support, ICCIDD has conducted independent evaluations of the Universal Salt Iodization Program in New Delhi, Madhya Pradesh, Sikkim, Kerala, Tamil Nadu, Orissa, Bihar and Goa.

There has been a tremendous increase in iodized salt production from 0.2 million tons in 1983 to 4.6 million tons in 2001. Coverage with adequate iodized salt is now 49%, according to a survey completed in 1999. But that means the glass is only half full. To reach and sustain 100% coverage is necessary and possible but only when civil society is determined to make the effort.

3.3.2 Introduction

India is the second most populous country in the world with a population of 1027 million (2001 census). High prevalence of goitre and cretinism exists in Himalayan and sub-Himalayan goitre belt, 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 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 1984-86, the Indian Council of Medical Research (ICMR) carried out a multicentric IDD prevalence study. Nine states outside the traditional "Himalayan goitre belt" were studied for the prevalence of goitre and cretinism. A total of 409,923 individuals were examined. Overall goitre prevalence observed was 21.1 percent and the overall cretinism prevalence was 0.7 percent.

In India, it is estimated that 200 million people are at risk. While the number of persons suffering from goitre and other iodine deficiency disorders is above 70 million. Results of sample surveys conducted by different agencies in 312 districts of 28 states and 5 union territories have shown a high prevalence of IDD in 254 districts. No state and Union Territory in the country is free from IDD as a public health problem.

This places India among the major endemic iodine deficiency countries of the world. Immediate steps are therefore required to ensure that iodine adequated iodized salt, reaches all the afflicted populations, at the earliest.

3.3.3 The Beginning: The Kangra Valley Project (1956-1972)

The importance of IDD elimination as a public health problem in India began in 1956 with a pioneering effort by Professor Ramalingaswami and his team from the All India Institute of Medical Sciences (AIIMS) Indian Council of Medical Research (ICMR) and the state government of Punjab. The team instituted a field trial to test the effectiveness of iodine-fortified salt in the reduction of goitre prevalence. The study was a community based prospective controlled trial conducted in over 100,000 people in the Kangra District of Himachal Pradesh in North India. The duration of the study was from 16 years from 1956-1972 (Sooch et al 1973).

It was concluded from this study that adequately iodized salt on a regular and continuous basis reduces goitre prevalence. The study also demonstrated that iodine deficiency was the most important cause of goitre.

On the basis of this study, the Government of India launched the National Goitre Control Program (NGCP) in 1962, at the end of the Second Five Year Plan (Pandav et al 1988). In the beginning, the NGCP was proposed to be an area specific or targeted program, providing iodine supplementation in the form of iodized salt to only those districts where goitre was in endemic proportions, i.e., total goitre prevalence of 10% or more in the general population.

3.3.4 The Turning Point: Meeting with Mrs Indira Gandhi, Prime Minister of India in 1983-Acceleration of the National Goitre Control Program

The National Goitre Control Program, from its inception in 1962, remained a low priority health program since goitre was mainly considered a cosmetic problem. The turning point in the program implementation in India came about with a meeting with the then Prime Minister of India, Mrs. Indira Gandhi. Researchers and academicians, concerned about the brain damage that iodine deficiency was inflicting on the population, made a presentation. The Indian Council of Medical Research made a film on iodine deficiency and human resource development, titled "**Will The Salt Reach Padrauna?**" Padrauna is a severely iodine deficient area in northeastern Uttar Pradesh. Here, the serious effects of iodine deficiency including cretinism were widely prevalent. Iodine deficiency was so severe that even birds and animals had goitre. The film was shown to Mrs. Gandhi. The Prime Minister was also briefed that endemic goitre was a public health problem in all the states and union territories. In addition, Indian scientists demonstrated the serious effects of iodine deficiency on brain development as measured by IQ in school children living in iodine deficient and iodine sufficient areas. The scientists also carried out studies in Uttar Pradesh and Bihar by adapting modern methods of investigations i.e. by estimating thyroid hormones in cord blood samples collected on filter paper (Kochipillai, Karmarkar, Godbole, Pandav). They reported a high incidence of neonatal hypothyroidism, almost 80 to 300 times more than in iodine sufficient areas. This was a study where 20,000 newborns were screened from different areas of India, Nepal, Bhutan (Kochupillai & Pandav 1987). The incidence of neonatal hypothyroidism was correlated with the severity of iodine deficiency as assessed by a) the pattern of urinary iodine excretion b) the prevalence of goitre c) the prevalence of cretinism. In areas where the population could be classified as Follis Group V (>50% have urinary iodines of <25µg/g of creatinine) the incidence of neonatal chemical hypothyroidism (NCH) varied from 75 to 133 per thousand births–this included Bhutan with an incidence of 115 per thousand births, Deoria, Gorakhpur and Gonda in Uttar Pradesh state of India with incidences of 133, 85, and 74, respectively, per thousand births. In areas of milder degree, like Delhi, which falls into Follis Group II (No proportion have urinary iodine <25µg/g of creatinine), with no cretinism, the incidence of NCH was 6 per thousand live births. It was evident, from this data and from other concurrent studies on the impact of high NCH on the endemic areas, to the Prime Minister that in seriously iodine deficient environments, in addition to the few clinically obvious cretins, a large number of individuals suffer from varying degrees of impairment of brain function due to intrauterine and neonatal hypothyroidism due to iodine deficiency.

The Prime Minister was also apprised of the scientific fact as reported by the World Health Organization (WHO) that iodine deficiency is the single most important cause of mental handicap in the world. Children who live in iodine deficient environment on an average have 13 IQ points less than those who live iodine sufficient environment. In order to fulfill the commitment of "Education for All" and consequent human resource development, the need to address the problem of iodine deficiency as early as possible was highlighted.

The response from the Prime Minister was immediate and definitive. IDD was redefined as a National Development problem, with far reaching consequences. Universal Salt Iodization was accepted as the strategy for IDD elimination. As compared to the area specific salt iodization that had been carried out under the activities of the NGCP till then, this move underlined the earnest commitment of the Prime Minister in addressing this issue.

The most farsighted decision that was made by Mrs. Gandhi was the liberalization of the production of iodized salt. The private sector was permitted and encouraged to produce iodized salt. A package of incentives was given and the private sector responded overwhelmingly. Within a period of two years, the capacity of production went up eight times from 0.2 million tons per year to 1.6 million tons per year (Prakash et al 2000) with actual production from 0.2 million tons to 0.7 million tons.

The Prime Minister also made it a point to include the elimination of goitre (the term IDD had not been used widely then) as "Point eight" in the Prime Minister's "20-point National Development Program, thus giving it a high priority. This inclusion also ensured regular monitoring of the program at the highest level.

Soon after the meeting with the Prime Minister, the Central Council of Health, the highest health policymaking body, met in 1984. One of the points of discussion was the National Goitre Control Program.

Keeping in mind the priority given to the Program by the Prime Minister, in view of the serious consequences related to mental and physical development of the children, the widespread prevalence of IDD as a public health problem in all the States and Union Territories and the availability of a physiological, low-cost affordable and acceptable intervention in the form of iodized salt, it was decided that iodization of all edible salt in the country by 1990 would be a desirable goal. The priority would be given to the endemic zones. The resource allocation to attain this goal was increased to Rs.200 million in the Seventh Five Year Plan (1985-1990).

3.3.5 Progress Since 1984

Since its inception in 1962, the NGCP had been languishing. With the boost given in 1984, the program activities accelerated. The installed capacity of iodized salt production increased from 1.6 million tons in 1986 to 14 million tons in 2000, an almost 9-fold increase! The actual production of iodized salt, which was close to 0.2 million tons in 1986, increased to 4.6 million tons in 2001. (Report to Government of India 2001).

In keeping with the new scientific evidence being discovered the National Goitre Control Program (NGCP) was renamed as the National Iodine Deficiency Disorders Control Program (NIDDCP) in 1992. The government had perceived the importance of eliminating the whole spectrum of disorders that is caused by iodine deficiency and not just goitre - which is only the tip of the iceberg.

Fig. 1 *The Installed Capacity and Actual Production of iodized salt from 1983-2000*

The International Council for Control of Iodine Deficiency Disorders (ICCIDD), in close partnership with the All India Institute of Medical Sciences, New Delhi, UNICEF Micronutrient Initiative (MI) and WHO. India has played a significant role in strengthening IDD elimination efforts made by the State Governments, Salt Commissioner's Office and iodized salt producers.

Apart from the technical assistance given to the Government of India and other agencies, ICCIDD has also conducted independent survey evaluation of the Universal Salt Iodization Program in New Delhi (Pandav et al 1980, 1997); Madhya Pradesh (ICCIDD 1996), Sikkim (Sankar et al 1994, 1997) Kerala, Tamil Nadu, Orissa, Bihar and Goa. In New Delhi, ICCIDD has a system in place, where the schools are being enlisted regularly for monitoring of the program (Pandav et al 1999). The ICCIDD has also forged collaborative partnerships with a network NGOs like Voluntary Health Association of India, Bharat Scouts and Guides, among others, all over the country.

3.3.6 National Family Health Survey – 2 (1998-1999)

The National Family Health Survey–2 was the second in the series of all India surveys carried out to monitor the maternal and child health indicators in the country, using a representative sample (IIPS Survey 1998-99). In the second edition of the survey, the consumption of iodized salt at the household level was included as one of the parameters. The salt at the household level was tested with the use of the rapid Salt Testing Kits (STK). The results showed that 49% of the households in the country were using adequately iodized salt, iodine content $\geq$15 parts per million (ppm), as measured by the salt testing kits. A total of 28% of the households were found to be using non-iodized salt. Another 22% were using salt that had iodine less than the recommended levels of 15 parts per million. The encouraging aspect of the results was that 71% of the population is consuming salt with some amount of iodine in it. Now the focus would be to sustain these achievements, improve the quality assurance and focus on the remaining 28% of the population, which is yet to be covered. Efforts are directed to make the consumption adequately iodized salt universal and sustain it thereafter.

3.3.7 Year 2000 and Beyond

In 1997, in a move to increase the sale and consumption of iodized salt, the Government of India banned the storage and sale of common salt for human consumption. This move, though well intentioned may well have been the cause for the protesting voices raised against Universal Salt Iodization, as the implementation of this order by the government raised the question of choice by the consumers.

On September 13, 2000, the Government of India lifted the ban at the national level on the sale of non-iodized salt (India Gazette 2000). However, except for two states (Gujarat and Orissa) the remaining states did not lift the Ban. (Later on Orissa introduced the ban again) The reason given was that, “When the question was of individual choice, compulsion is undesirable”.

Some of the factors that may have been responsible for the government taking this drastic move were:

1) Price difference between iodized and common salt
2) Difficulties faced by the salt producers under the Prevention of Food Adulteration (PFA) Act, 1954.
3) Politics and economics of Liberalization
4) Principle of Choice

The two main reasons may possibly be the price difference between packaged refined free flowing iodized salt and the common salt available and the difficulties faced by the small scale salt producers under the PFA Act, which had stringent penalties for not conforming to the standards set by the government.

The price of the packaged refined free flowing iodized salt is two to three times more than the price of the common salt. But, invariably, the price of this high quality branded product is compared to the price of the non-packaged common salt available in the market. Some groups highlight the price difference, but this is true for all the products. In the absence of price control mechanisms, the market forces govern the sale of the salt, slightly tilting towards the product, which has added value–be it in terms of appearance, packaging, labelling and other sales promotion strategies. But the fact remains that more than 80% of the salt that is sold in the country is in the crystal or powdered form. Another widespread misconception of the people is that the packaged refined salt is the only salt in the market that is iodized. In point of fact, even crystal and powdered salt can be effectively iodized.

The second objection was raised to the interpretation given by the government officials to the Prevention of Food Adulteration Act, under which iodized salt sale was governed. Under this Act, if the salt sample did not have 30 parts per million of iodine at the production level or 15 parts per million of iodine at the consumption level, then the salt manufacturer could be taken to Court in the area or state where the salt sample was collected and analysed, regardless of the place of origin of the salt and the salt manufacturer. This was treated akin to a criminal offence, punishable with a monetary fine and a jail sentence. The PFA inspectors, in their efforts to rigidly implement the rule, ignored some of the genuine problems that the salt producers were facing, where the salt produced by someone else had their address on its cover and they were being summoned in court for someone else's negligence. The salt producers, who had actively gone out of their way to support this program from the very beginning, were unhappy with the treatment and consequent harassment being meted out to them. These social issues are not easily tackled by quantitative scientific methods and the concept of qualitative research methodology plays an important part in understanding the process related to legislation and enforcement.

The Government policy of promotion of production of good quality iodized salt is in place and remains unchanged. The status with respect to lifting the ban on sale of common salt situation remains very fluid. So far, two states, Orissa and Gujarat out of 35 administrative regions have lifted the ban following the Central Governments order lifting the ban at the national level. Later on Orissa reintroduced the Ban again. It is important to note here that in India, health is a state issue. Therefore, it is the state ban that decides the implementation of legislation with respect to iodized salt.

3.3.8 The Production of Iodized Salt

The Salt producers and the various associations of the salt producers in the different salt producing states have performed a great enormous service to make India self sufficient in the production of common salt. India has more than required capacity to produce iodized salt. The salt producers and the salt traders are spurred by three main factors:

i) Economic incentives
ii) Technical support
ii) Social incentives

i) Economic incentives

All iodized salt in the country is produced mainly in three states: Gujarat in west India, Rajasthan in northwest India and Tamil Nadu in South India. The salt is then transported from these production centers to the rest of the country by road and rail transport. For distances beyond 500 kilometers, it is economical to transport the salt by the rail route. In an effort to induce the salt producers to manufacture only iodized salt, the Government of India and the Ministry of Railways have introduced iodized salt under the Category B priority. This ensures that it is placed behind Defence in terms of the priority given to its transport. If the turnover of the iodized salt is good and the transport of the product is assured at a lesser rate (as compared to road transport), then it makes good business sense to invest in the manufacture of iodized salt.

ii) Technical Support

The salt producers have been receiving support from the government in that a separate department, the Salt Commissioners office, under the Ministry of Industry provides technical assistance to monitor the quality of iodized salt at the production level. Bilateral and international agencies like UNICEF, MI, WHO and ICCIDD have been regularly contributing their time, resources and expertise in ensuring that the salt production is of the highest quality.

iii) Social Incentive

The salt producers have also fulfilled their commitment to the children of India. By ensuring the supply of iodized salt to all areas in the country, they are giving each and every growing fetus and child an opportunity for optimum mental and physical development. The economic development of a society alone is not sufficient for overall improvement of the health status of a community; there has also to be a social change bringing about equity and equality of distribution of development in the community.

The creation of a demand for iodized salt or the provision of an adequate supply of iodized salt is necessary but not sufficient for the IDD Elimination Program to run independently. This has to be bolstered by regular, reliable, representative, state level scientific data and data for decision-makers.

3.3.9 Data for Decision Makers and Sustained Political Commitment

With the varying geopolitical and socio-economic zones in India, it is very difficult to consider the whole country as a study unit. As a result, there have been no country evaluations on IDD in India. The only study that can be considered a countrywide study is the ICMR study conducted in 1984-86 (ICMR 1989). Other than the ICMR study, the data is mainly at the district level in the various states, from studies conducted by the National IDD Control Program and also by independent investigators. There is also a large variation in the methodology of the studies, which do not lend them to inter-study comparisons. There exists paucity in regular, reliable, representative, state level scientific data, which can be presented to the policy makers as an index of tracking progress towards sustainable elimination of IDD.

Continuing political support and commitment to sustain the progress that India has displayed in 15 years of Universal Salt iodization, and over 50 years of research on IDD, is very important. There have been instances from Thailand, Ecuador, Guatemala, Peru and Brazil, to cite a few case studies, where IDD has reappeared as a public health problem, after a let-up in the sustenance of the IDD elimination efforts (IDD Newsletter 1992, 1994, 2000).

In summary, the foremost task is the collection of regular, reliable, representative, state level scientific data to convince the policy makers of the seriousness of the problem. In India, Public Interest Litigations (PIL) has been filed in the Supreme Court, (the highest judicial body of the country) questioning the Government's decision to lift the ban. Be that as it may, the communication focus now should be towards the role of iodine and iodized salt in the optimum physical and mental development of the children of India.

IDD is an ecological problem, a disease of the soil causing a nutritional imbalance in human beings. Since the vehicle chosen to deliver iodine is salt, the solution of providing adequately iodized salt to people cuts across many disciplines besides health sciences. Technical support by a body of scientists and professionals is the core effort, and substantial inputs from professionals in other fields like sociology, qualitative research methodology and anthropology are also essential. The salt industry should have the mandate and the access to resources to ensure effective iodization. Producer compliance, quality assurance, logistical problems and bottlenecks need to be addressed through effective advocacy and social communications. Monitoring systems should be in place to ensure specified salt iodine content and to coordinate effective regulation and enforcement. The solution lies in understanding the social scenario and the community's perception of the problem. Also essential to the efforts is the establishment of various partnerships between the stakeholders to ensure sustainability.

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4

China and East Asia Region

R Yip, ZP Chen, J Ling Creswell J Eastman and Mu Li

4.1 People's Republic of China

4.2 Tibet

4.3 Mongolia

4.4 Democratic Republic of Korea

4.1

People's Republic of China

R Yip, ZP Chen, J Ling

4.1.1 Summary of the China experience

The experience of China in rapidly achieving IDD elimination with continuing effort to sustain the achievement can be summarized as follows:

- ➢ Effective initial advocacy to the senior leaders resulted in the strong policy support for IDD Elimination–a model of international cooperation resulted in high level commitment
  - o Sound argument based on IDD damage to child intelligence with clear implications on human resource and economic development
  - o A feasible solution based on improving the function of the existing salt industry
- ➢ The primary instrument for IDD elimination is the reform and centralized management of the salt industry to assure only iodized salt is used for human consumption based on the historic and current economic framework of China
  - o Limit salt production and distribution to selected large producers and provide assistance to improve their production quality
  - o Regulated salt price to assure profit for the producer of iodized salt
  - o Effective salt administrative system to stop the flow of non-iodized salt which is funded by the profit of the salt industry
- ➢ Adequate IDD surveillance and salt quality assurance - sustained IDD and salt monitoring has become the major tool of the National IDD elimination program
  - o Ability to monitor progress by measurement of salt and urine iodine
  - o Ability to detect small areas where USI has relapsed
  - o Proven to be a useful as an evidence-based tool for advocacy
- ➢ Periodic re-advocacy and remobilization to sustain the national and local interest in IDD elimination-keeping the IDD issue alive
- ➢ The use of health promotion strategically–targeting those areas where there is significant competition between iodized and non-iodized salt
  - o A clear role for the health sector in addition to IDD surveillance
  - o Consumer marketing by the salt industry–beyond salt distribution alone
- ➢ Targeting remaining non-USI areas as part of the overall strategy to sustain the IDD elimination effort–keep the IDD elimination effort ongoing by intensified action helps to keep the IDD issue alive at national level.
- ➢ The National IDD Advisory Committee plays an important role in technical support by coordination of different technical bodies for the implementation of the National IDD Program

4.1.2 Introduction

Iodine Deficiency was recorded, as goitre, in the ancient Chinese medical literature as early as 3,000BC. It was one of the very significant public health problems and has continued to threaten the quality of life, human potential and socio economic development in China. Prior to the national effort to eliminate iodine deficiency disorders (IDD), in the 1990s, 700 million people, were estimated to live in iodine deficient areas and therefore were at risk of its impact. Epidemiological surveys revealed there were 35 million IDD affected individuals based on the presence of goitre, 250,000 with typical cretinism **(fig. 1)**. In addition mild mental retardation (IQ 50-69) occurred in 5-15% of the children in many IDD endemic areas (Ma & Lu 1996).

The most important epidemiological survey, clinical investigation and intervention study in Chengde, Hebei Province in 1960, was led by Prof Xianyi Zhu (HI Chu) and Dr T Ma and their endocrine research group from the Tianjin Medical College (Ma et al 1982). This study demonstrated that iodine deficiency was the main etiology for endemic goitre and endemic cretinism and demonstrated that iodized salt was the most effective intervention for correction of iodine deficiency in the whole population. (Ma et al 1998)

Later, their effort was assisted by several Australian IDD experts– Professors Basil Hetzel, Creswell Eastman, and Glen Maberly. This early work provided the scientific basis for the start-up effort for IDD elimination in China in the 1980s. One important outcome of the research and investigation of Dr T Ma was the documentation that children who had grown up in IDD endemic areas had significantly lower intelligence in contrast to children who had grown up in areas not significantly affected by iodine deficiency (IDD Newsletter 14: 1998). The IQ distribution curves of children have a general tendency to shift to the left with an average IQ deficit of 10 points for populations living in known IDD endemic areas. Most of the mild mental retardation in IDD areas was attributed to iodine deficiency and because of the sub-clinical nature of mental retardation, these subjects have been called “sub-cretins” in China (Liu Cheng-Shan et al, 1987).

In the 1950s and 1960s, health authorities tried to improve the supply of iodized salt to control goitre but the measures were limited to highly endemic areas. With the new findings of the impact of IDD, the government soon adopted the iodized salt program (KI 10-30ppm at production level) as the main strategy for all IDD endemic areas. Although goitre rate was

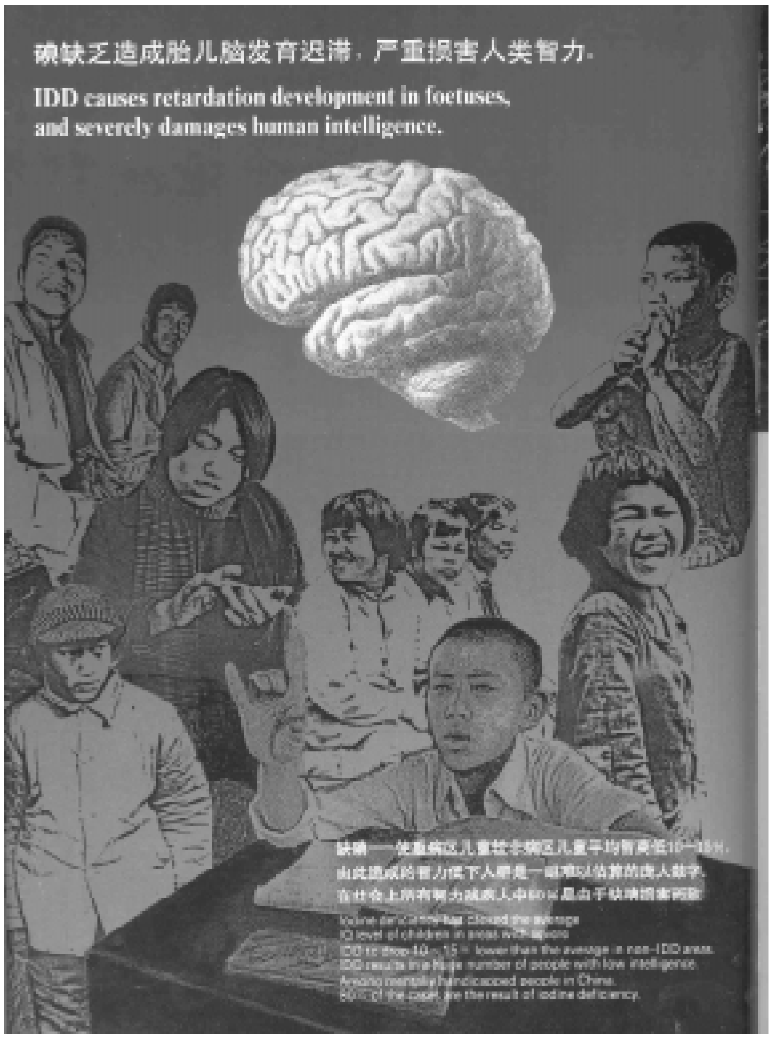


Fig. 1 *Brain and Cretins*
Source: Sounding the Alarm, Dept. of Disease Control, Ministry of Health, People's Republic of China, 1993.

decreased and very few cretins were born, IDD was not under control due to a lack of strong political will, irregular salt iodization and no effective monitoring system. This period is well covered in a previous Report (Ma and Lu 1996).

The strength of the evidence from Prof Ma Tai's work that iodine deficiency was later associated with significantly reduced IQ was further supported by the consistent findings of multiple studies of similar design coming from different parts of China. A meta-analysis of 36 such studies conducted in China found the average reduction in IQ was 11 points (Qiang et al 2000). The recognition of a general damage of cognitive performance with impaired child development elevated the concern for IDD from an endocrine problem of thyroid dysfunction resulting in goitre to that of reduction in human resources and constrained economic development. The damage of iodine deficiency used to be seen as being limited to very few unfortunate children who were cretins, whereas the newer evidence showed that all children in affected areas were shortchanged, indicating a much higher burden. The findings on reduced cognitive performance and lower intelligence in China led to a serious national commitment and effort to eliminate IDD.

4.1.3 1993 Advocacy Meeting

In 1990, the historic UN Summit for Children adopted a series of goals, one of which was the virtual elimination of IDD. Premier Li Peng signed the Summit declaration on behalf of China **(fig 2)**. The late Minister of Health, Dr. Chen Mingzhang, brought the issue to the attention of State Council through Madam Peng Peiyun. A consortium of international agencies, including WHO, UNICEF, World Bank, UNIDO, UNDP, ICCIDD, and bilateral donors such as AusAID and CIDA, was ready to provide assistance to a national effort. The State Council's Madam Peng hosted a high-level advocacy meeting in September 1993, involving national leaders from various sectors and provincial governors. It was a defining event for the national IDD program (Ministry of Health 2003).

The meeting resulted in the establishment of the multi-sectoral State Council Leading Group for IDD Elimination headed by Madam Peng herself **(fig 3)**. The commitment at the UN Summit became an action program involving all provincial leadership. The Department of Endemic Diseases of the Ministry of Health assumed the leadership of the technical work of the Leading Group. A training and coordination unit, the National Training and Technical Service (NTTS), was subsequently created to service the national program (Ministry of Health 2003).

Fig. 2 *Li Peng (Chinese Premier) Signing the Declaration from the World Summit for Children*
Source: Sounding the Alarm, Dept. of Disease Control, Ministry of Health, People's Republic of China, 1993.

The State Council approved a new National IDD Control Program with mandatory salt iodization. USI was accepted as the major intervention. Health Education and the IDD Day would play an important role in social mobilisation. National Monitoring was planned to be implemented every two years by using WHO/UNICEF/ICCIDD criteria for monitoring progress towards eliminating IDD as a significant public health problem (WHO/UNICEF/ICCIDD 2001).

4.1.4 State Council Decision

The decision to launch the national program, to a large extent, was made by the then Vice-Premier, Mr. Zhu Rongji, who was impressed by the fact that the principal damage of IDD concerned children of lower intelligence, as it was presented to him during a small gathering of senior national and international experts on IDD. As an economist, Vice-Premier Zhu understood the implication of IDD for human and economic development, and he inquired about the solution to the problem. The experts present made it clear that, if all the salt could be properly iodized, IDD could be eliminated. Mr. Zhu who had attended the advocacy meeting indicated to all those present, "I will make sure it is done" (Chen 1993). In

Fig. 3 *Mme Peng (Member of State Council) Promotes iodized salt Source: Sounding the Alarm, Dept. of Disease Control, Ministry of Health, People's Republic of China, 1993.*

essence, the high-level advocacy event was able to create the opportunity for the most senior leader in charge of economic development to make an on-the-spot decision.

For the enhanced IDD surveillance system, each province is considered as a basic unit for epidemiological survey. The PPS cluster method was accepted for assessing IDD prevalence. Schoolchildren aged 8-10 years old were chosen as the target population. The National and Provincial Monitoring System on iodized salt was also set up to monitor the consumption pattern of iodised salt.

4.1.5 Progress against IDD

Throughout the second half of the 1990s China made a remarkable effort in IDD elimination–it increased the iodized salt supply for human consumption from less than 40% to 90% to reach the goal of Universal Salt Iodization (USI) in 2000. To a large extent, this was the result of the concerted efforts of the national IDD elimination program supported at the highest level by government leaders who achieved the revitalization of the salt industry. This effort, which was started in the early 1990s with resulting USI by 2000, has been regarded as the first major phase of the IDD elimination program.

Currently, the government of China is in the Second Phase of the IDD elimination effort focusing on the remaining 10% of the population still under IDD threat, while also striving to sustain an IDD free status in the areas, which had already achieved USI.

This chapter will describe the process by which China made rapid progress towards USI in a relatively short period of time (First Phase of IDD elimination), and the current challenge and strategy required to assure that all areas can reach USI (the Second Phase of IDD elimination).

4.1.5.1 The IDD and salt industry situation before 1990

About 60% of the land of China is low in iodine content. The distribution of iodine deficient soil follows an east to west gradient– virtually most of the western part of China, which is at higher elevation, is at risk for IDD. Many communities in western China are known to be severely affected areas with a high prevalence of goitre and cretinism. Many parts of China were defined as IDD endemic areas based on various local IDD surveys, mainly based on the observation of a significant level of goitre. By the end of the 1980s about 480 million people or close to half of the national population was living in the recognised IDD endemic areas. To a large extent, IDD intervention by salt iodization and distribution of iodine capsules was based on the presence of goitre. The use of non standardized goitre surveys resulted in many IDD affected areas failing to be recognised due to either lack of surveys or perceived low goitre prevalence.

In 1995 when the first National Survey on IDD status was conducted as part of the National Program for IDD Elimination, only 39% of households were found to be consuming iodized salt (Ma et al 1982). This targeted distribution of iodized salt by area was later abandoned, and switched to the current model of universal protection with iodized salt.

The salt production and salt trade in China has been well documented over the last two thousand years. Throughout history, even after the founding of the People's Republic of China in 1949, the salt trade has been tightly controlled by the central government. Throughout the dynasties, income drawn from salt was a major source of revenue for the ruling family, and the senior official who was in charge of the Bureau of Salt Affairs was comparable in importance to the current day Minister of Finance. After the founding of the People's Republic of China in 1949, the Salt Administration Bureau was maintained under the supervision of the Ministry of Finance; then in 1956 the responsibility was switched to the Ministry of Light Industry (Ding and Tong 1997).

4.1.5.2 State Salt Monopoly

The monopoly of the salt trade was maintained in part because all industries were managed by a centrally planned mechanism resulting in a limited number of production facilities often with inefficient operation.. Prior to the liberation of salt industry control, all salt manufacturers were state-owned enterprises, and only salt for IDD endemic areas was iodized, which was a practice started in the 1960s. The overall capacity for production of processed salt of 3 million tons by state owned producers in 1980s, iodized or not, was below the needed national consumption of nearly 5 million tons. This meant that non-processed raw salt made up a substantial part of the salt for household consumption. The liberalization of the salt industry and trade took place as part of the overall economic reform. When the deregulation of the salt industry and market occurred, within ten years, a few thousand small producers owned by local governments sprang into action resulting in an oversupply of edible salt with varying quality. Fierce competition kept salt industry as a whole non-profitable. In such circumstances, it was not feasible to improve production facilities and to assure the quality of the salt.

4.1.6 First Phase of National IDD Elimination Program (1990-2000)

4.1.6.1 Advocacy–the key to the program

The key lessons from the 1993 landmark advocacy effort were that:

i) the argument presented must be strong–the cost of lower intelligence due to IDD is more persuasive to policy makers in contrast to high rates of goitre.
ii) a clear and feasible solution had to be defined (in contrast to “more research will tell us what to do”); and most importantly
iii) the need to influence the person who can truly make the decision. It is fair to conclude that strong and effective advocacy was the starting point leading to an effective National Program for IDD elimination.

4.1.6.2 Scope of the First Phase of the National IDD Elimination Program

After the high-level IDD advocacy event in 1993 which defined the need for a National Program for IDD elimination, the program started in 1994 with a series of activities focused on assuring the supply of iodized salt to all households through reforming and re-strengthening the operation of the salt industry. The goal of this national program was to reach the goal of Universal Salt Iodization (>90% iodized salt consumption for all households), as required by the World Summit for Children by the year 2000.

The key components of the National IDD elimination program were:

- Legislation and regulation to limit salt production to 118 authorized producers
- Upgrade the salt production capacity and quality of authorized producers
- Central planned production quota and distribution of iodized salt
- Improve the epidemiological and laboratory capacity for monitoring of IDD and iodized salt
- Health education to promote the use of iodized salt and the concept of IDD elimination.

It is the successful and coordinated implementation of these key activities, which has enabled China to make rapid progress towards the USI goal of 2000.

4.1.6.3 Legislation and Regulation for Salt Industry and market reform

One of the key decisions of the State Council to ensure that all edible salt was properly iodized was to reverse the course toward the free-market approach (started in the mid 1980s), and re-centralize the management of the salt industry as a quasi-monopoly, similar to the arrangement prior to the deregulation. Under a planned economy management, only authorized producers can produce and sell salt while the national and provincial salt bureaus determine the quota each producer can produce, and where they can distribute the salt. Such a measure has the net effect of eliminating much of the excess production, and concentrating the salt production in a smaller number of larger producers. The overall conceptual framework of the National IDD Elimination Program was issued in 1994 as a decree of the State Council signed by Premier Li Peng (State Council 1994). The key legislation, which was put into place by this decree (Ministry of Health 1994), is summarized below.

i) The management guideline for Salt Iodization for the Elimination of IDD

A guideline was issued in August 1994 as a decree of the State Council. This was an umbrella legislation, which specified that salt producers be under the direct management of provincial and municipal government, as part of the salt bureau system as of Oct 1, 1994. The key elements of this new law were:

- Provincial government was to regain the control of salt production, or re-monopolize the salt industry.
- Production quality and locations for distribution for each salt production unit were defined by national-level and provincial level salt cooperation–a centrally planned mechanism.
- Allowance for the increase of salt price to assure proper iodization and packaging
- The quality of the salt and iodine content must be defined as required

There were several specific regulations developed under the principle of this umbrella legislation, which define the specific elements of salt industry reform, and the requirement for proper monitoring.

4.1.6.4 Salt Industry Reform and Development

Re-centralization of the salt industry, using a centrally planned mechanism in the management of salt production and distribution. The policy and legislation for the resumption of the salt industry in a centrally planned fashion provided the framework for a highly regulated salt market where it was easier to assure quality production and iodization. Based on this reform plan, a total of 118 large salt producers across China were licensed to produce salt for human consumption, and this resulted in a rapid phasing out of most small to medium size producers. For the most part, this phasing-out process did not meet any resistance, because most of the smaller salt production facilities were government owned enterprises, and most local governments observed the orders coming from the central government. The remaining large-scale salt producers were managed by the provincial-level Salt Corporation, which is the enterprise arm of the provincial Salt Bureau. On the national level, the China National Salt Industry Corporation under the Ministry of Light Industry was re-established to provide guidance and supervision for the provincial level salt corporation.

The most important function of the China National Salt Industry Corporation is to define the production quota for each salt production facility and allocate the geographic areas for distribution. This resumption of the centrally planned production and distribution had the net result of assuring salt distribution to most areas (but not all remote areas), and eliminating the competition in areas where salt supply was plentiful. This anti-market competition measure coupled with price fixing, as commonly done with many commodities in China, actually allowed most of the remaining salt producers to operate with some profit, and the provincial salt cooperation to be very profitable because of the large differential in price paid to producers and the wholesale price. Most of the remaining salt producers and provincial salt corporations well understood that the favorable policy that created this semi-monopoly system was the principal instrument for IDD elimination which indicated that the proper iodization of salt was regarded as an important task.

Upgrade the production facility of salt producers–assure the quality of salt and proper iodization.

Coupled with this new policy was the allocation of government funds to support the capital improvement of the salt production facilities. As part of the United Nations support system for the National IDD Elimination Program of China, the World Bank was able to fast track a loan of US$27 million dollars in 1995 together with funds authorized by the government to support the upgrade of physical infrastructure of the authorized salt production facilities (World Bank Report 2001). By 2002, near the conclusion of this physical facility upgrade project, the government of China had invested US$110 million, in addition to the World Bank loan. The net result was that, the majority of the 118 large-scale salt production facilities which were defined as authorized producers have been fully modernized and a number of these producers were able to provide effective iodization, starting in 1996. A logo for quality iodine salt was introduced in 1997 for inclusion on the retail salt package from the qualified producers, which also symbolized the role of iodine and human intelligence **(fig. 4)**.

It is clear that the combination of the reform policy to re-centralize the salt industry coupled with the physical upgrade were the two critical and complementary measures leading to the rapid progress of USI in China. At the time when the World Bank Loan was planned, there was a controversy among the key government agencies concerning the use of the loan for the IDD elimination effort. Traditionally, it is the health authority that takes the lead in all the IDD elimination effort, as was the case in China. It was viewed as unusual for a major international loan not to be executed by the lead agency; instead it was assigned to the salt industry with the China National Salt Industry Corporation as the executing agency. This break of tradition of having a project aimed at the elimination of a health problem managed by non-health partners did meet resistance

Fig. 4 *The official logo for quality iodized salt produced by all authorized salt producers. The Chinese character on the person means "Iodine", and the overall symbol implies that iodine is good for intelligence or smartness. This logo is now incorporated in the anti-counterfeit label affixed to all retail salt packages sold in China.*

from some of the health managers. The fact that this project was able to address the central issue of IDD elimination–assure the supply of iodized salt–resulting in USI by 2000 demonstrated the soundness of the investment strategy (World Bank Report 2002).

4.1.6.5 Dual function of the Salt Administrative Bureau–regulators and enterprise

One of the outcomes of the re-centralization of China's salt trade was that the provincial Salt Administrative Bureaus suddenly became responsible for the production, distribution and wholesaler of salt, beyond their previous administrative role of market inspection of salt from all sources. The combination of the role of enterprise and regulator was viewed by many as a clear conflict of interest. From a historic point of view, prior to the deregulation of the salt trade in the early 1980s, the Salt Bureau had always enjoyed the dual role for centuries–monopoly of salt trade. Given the newly defined rules for salt industry and trade reform, only authorized government owned large-scale facilities can produce salt, which is overseen by the provincial Salt Administrative Bureaus. Any salt produced by unauthorized producers is classified as illegal salt, subject to confiscation by the inspectors of Salt Administrative Bureau.

The Salt Administrative Bureau for sometime was a sub-agency under the Ministry of Light Industry even after the salt industry reform took place. In 1998, with the government reorganization, this particular Ministry was disbanded, and supervisory responsibility was transferred to the Commission for Industry and Trade. The Commission assumed the direct management role of the Salt Administrative Bureau at national level in 2001, but at provincial level and below, the work force for the Salt Administrative Bureau was still managed and financed by the provincial salt company. In 2003, the Commission for Industry and Trade became a division of the highest planning body of China, the Development and Reform Commission, which also supervised the operation of the National Salt Industry Cooperation. This latest supervisory arrangement will probably assure the dual function for the near future.

Enforcement measures against the trade of illegal salt by the Salt Administrative Bureau

The inspectors of the Salt Administrative Bureau are called the "salt police". By 2000, there was a total of 25,000 salt police in service across China. To a large extent, they played a major role in eliminating the trade of non-iodized salt for human consumption by stopping the transport and sales of "illegal salt"–salt not produced by authorized facilities, or even out-of-quota production from the authorized facilities. Most of the illegal salt produced outside the government-sanctioned facility was lower quality salt and non-iodized salt mostly intended for the black market as edible salt. Also, the production of lower quality and much lower priced salt for industrial use was often diverted as black market edible salt. Stopping the flow of this salt had the net effect in reducing the trade and use of non-iodized salt.

In essence, the Salt Administrative Bureau had the legal mandate to put any competitor of edible salt out of business. Hence it is a form of monopoly. The cost for maintaining the salt police force is funded by the profit from sale of the "legal salt". This unusual arrangement turned out to be an effective mechanism in assuring the rapid implementation of USI. The dual function of the salt bureau was able to stop the flow of non-iodized salt in many parts of China within the first few years of this new arrangement. Prior to the new reform rule, the inspector of the Salt Bureau was supposed to inspect and stop the trading of salt that did not meet the quality standard. Because of under funding of the Salt Bureau function, and no incentive in carrying out the task, non-iodized or low-quality salt had flowed freely in most markets. It is clear that, the re-vitalization of the

Table 1. *The three major IDD monitoring systems of China*

Systems	Indicators	Operational Feature	Comments
The National IDD Survey (MOH)	Iodized/non-iodized salt Goitre rate - school age Urinary iodine-school age TSH - newborn	- Epidemiologic survey using population proportion sampling method allows the character-ization of whole country and each province - Every 2 years - First one 1995	- requires special fund for each round of survey - proven to be the most useful system for IDD monitoring due to ability to compare IDD and salt consumption status
The routine iodized salt monitoring by the Anti-Epidemic Stations (MOH)	Iodized salt - at production sites - at wholesale sites - retail sites - houehold level	- Quarterly measurements - Sample of salt from each of four levels using titration method - There is charge to salt production facility for the testing - Other levels no charge	- For those countries with salt factories the tasks are carried out and some even increase the frequency to monthly - Most provinces not able to carry out the routine function at household and retail level because of lack of funding support for such operation
The Salt Industry Quality Monitoring Program (CNSIC)	Salt quality Iodized salt	- Routine monitoring of iodine content at produciton site-multiple samples a day (internal quality control) - Monthly collection of 25 samples different lost at each production facility for all salt quality indicators	- The daily routine iodine content monitoring results are not reported but a record is kept at each facility - The reslut of monthly measurements are reported to the Quality Monitoring Unit of the CNSIC through computer network

Table 2: *Monitoring China National Program 1995-2002*

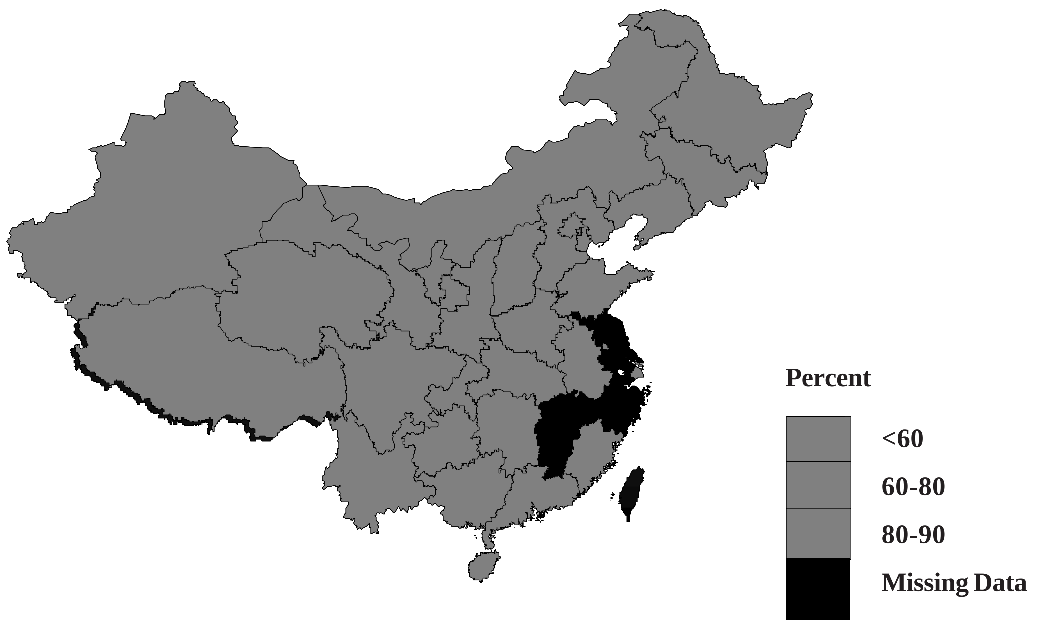
INDICATORS	1995	1997	1999	2002
The proportion of households consuming iodized salt				
20mg/kg (%)	39.9	81.1	88.9	95.2
20-50mg/kg	29.7	69.0	80.6	88.9
median iodine level	16.2	37.0	42.3	31.4
Urinary Iodine level in Children				
Median (μg/l	164.8	330.2	306.0	241.2
<50μg/L (%)	13.3	3.5	3.3	5.8
Number of Provinces				
With Median <100μg/l	3	1	1	1
Total Goitre Rate (TGR) (%)				
Palpation	20.4	10.9	8.8	5.8
Ultrasonography	---	9.6	8.0	5.6
Grade II	2.1	0.5	0.33	0.28
The production of iodized salt (10,000 tons)	---	539	620	753

traditional Salt Administrative Bureau system by giving them back the role as the sole legal salt distributor has greatly enhanced the effort to bring iodized salt to all households.

The effective enforcement mechanism of the salt police of the Salt Administrative Bureau system does not cover all parts of China. Only about two-thirds of the counties have a Salt Administrative Bureau station. Further extension of this system will enable better distribution of iodized salt, and enforcement to stop the flow of non-iodized salt.

However, this dual function of the Salt Administrative Bureau system is under review. Starting in 2001, the Commission of Internal Trade started to question this practice of dual role of enterprise and regulator, in part because the national economic development policy is to move all industry from state-owned management to a free-market based. In anticipation that such a breakup of the semi-monopoly practice may take place, the China National Salt Industry Corporation took the lead in forming a conglomerate called the China Salt Group with most of the Provincial Salt Corporations as members of this group. In the event of deregulation of the salt trade, the conglomerate members are in a better position to compete based on the scale of economy, and market dominance.

Iodized Salt Coverage at Household Level 1995



Note: Salt with iodine level >=15ppm; Range is 32.4% and 98.7%
Source: China National IDD Surveillance, 1999, MoH

Fig. 5. *1995 Surveys* ***The result of 1995 National IDD survey on iodized salt consumption level by province. Only Shanxi province had a consumption level higher than 80% and the overall national consumption level was 39% - which was the baseline at the start-up of the National IDD Elimination Program.***

4.1.7 IDD Monitoring and Iodized Salt Quality Assurance

At the start of the National IDD Elimination Program in 1994, one important component put into action parallel with the salt industry reform effort was the development of a mechanism for the monitoring or surveillance of IDD status including the consumption of iodized salt. To support the implementation of the monitoring and surveillance systems through the Ministry of Health system, a special unit called the National Support Team for Elimination of IDD, within the current China Centers for Disease Control (CCDC) was established. Starting in 1995, a total of three separate surveillance systems was put into operation–two managed by the National IDD Support Team on behalf of the Ministry of Health, and one by the China National Salt Industry Corporation (CNSIC). **Table 1** summarizes the key features of each system.

4.1.7.1 The National IDD Survey System (1995-2002)

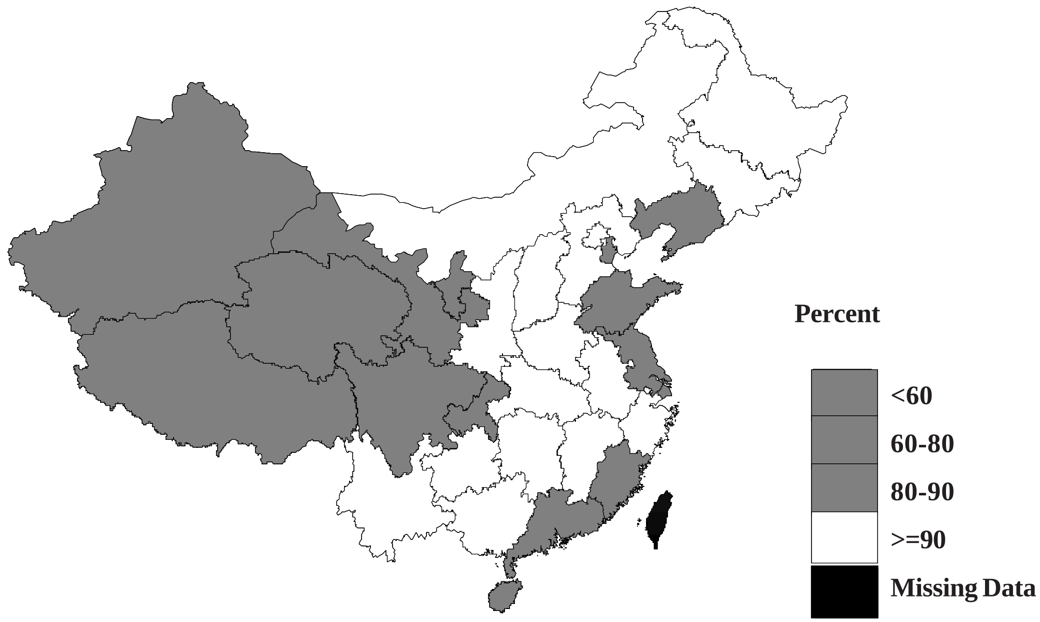
The National IDD survey was the base line survey in 1995, prior to all major measures to improve the supply of iodized salt. In this survey the overall household iodized salt consumption rate was 39% based on iodine content greater than 15ppm **(Table 2)** (Ministry of Health 1996) **(fig. 5)**.

Among the 31 provinces and municipalities only one province (Shanxi) had an iodized salt coverage rate over 80%. The median urinary iodine level was 165µg/dl.

So far, the national survey has been carried out four times (1995, 1997, 1999, and 2002) using a comparable design allowing for comparison over time. This system has proven to be the most valuable and credible monitoring system for IDD status and iodized salt coverage down to provincial level. By 1999, the overall national household iodized salt consumption reached 90%, to provide the evidence of USI by 2000. **Table 2** illustrates the rapid improvement of the iodized salt consumption level based on the 1997 and 1999 National Surveys **(fig. 6)**.

Clearly, the most useful aspect of the survey-based IDD surveillance system is the proper monitoring of the principal process indicator for IDD elimination–the iodized salt. The system also demonstrated other uses. The finding of a relatively high median urinary iodine level in 1997 and 1999 (greater than 300µg/dl in a majority of the provinces) indicated that the iodine level of salt based on the requirement of 20-60ppm was higher than necessary. The finding of iodine content of salt from the survey's average 50ppm confirmed the urinary finding. Based on these findings, the national standard for iodized salt was changed to 35ppm±15ppm.

Iodized Salt Coverage at Household Level 1999



Note : Salt with iodine level >=15 ppm; Range is in 32.4% and 98.7%
Source: China National IDD Surveillance, 1999, MoH

Fig. 6. *1999 Surveys The result of 1999 National IDD survey found 21 provinces reached USI–iodized salt consumption level greater than 90%, and there were 10 provinces with very uneven level of consumption below 90%. The overall national consumption level reached the goal of 90% set for 2000. This survey was the principal evidence for China to declare USI at national level in 2000. This same map of iodized salt consumption also became the main tool to target the remaining areas for further intervention during the Second Phase of the National IDD Elimination Program.*

Table 3. *The laboratory system for the monitoring of IDD status*

System	Key Indicators	Role and Function
Central – The National IDD Reference Laboratory, China CDC (Centres for Disease Control and Prevention)	Iodine salt by titration Urinary iodine TSH	- Provide reference (QC) for laboratories of the network - Training support for provincial laboratories - Quality assurance program for the National Survey samples
Provincial - Provincial Endemic Disease Laboratory, Provincial CDC Total 31 laboratories	Iodine salt by titration Urinary iodine TSH	- Supervise and support the prefecture and country level laboratories - Analysis of samples of the National Survey
Prefecture - prefecture level Anti-epidemic station Total 330 laboratories	Iodine salt by titration Urinary iodine	- Salt testing for the routine monitoring of salt by the Disease Control System - Support the function of the Country level laboratories
County - county level Anti-epidemic station Total 2450 laboratories	Iodine salt by titration	- Salt testing for the routine monitoring of salt by the Disease Control System

This resulted in a fall in urine iodine **(Table 2)** due to a reduction of one third in the use of potassium iodate by the salt producers. The only key indicator, which was not found to be useful, was TSH in newborns. This had to do with variation in methods used across provinces, which renders the results difficult to compare across the country, and over time. For the 2002 survey, TSH was discontinued as one of the required measurements.

4.1.7.2 The routine monitoring of salt by the Anti Epidemic Stations

This county-based system was designed for regular monitoring at production, wholesale and household level. In principle this is a mechanism that would be most useful in defining areas needing attention and action based on the nature of the problem such as excess raw salt production, or lack of iodized salt distribution. To complement this need, a network of IDD laboratories was set up as part of the National IDD

Elimination Project through the support of AusAID, UNICEF and WHO in the late 1990s. Evaluation found the system functioning well in selected provinces where there was provincial funding and management input to this system. Unfortunately, most of the provinces, which are more affected by IDD, are also poor provinces where provincial governments are not able to provide the basic input to assure the system operation. The only functioning part of this routine monitoring system is the periodic check of iodine content of salt at the production facility, for those few counties where there were production facilities. The main reason this aspect of the system is working is that the cost of this operation is offset by the charge to salt producers for “inspection” as well as a fine levied if the salt inspected is found to contain iodine less than 20ppm. This provided a useful function of external monitoring of iodized salt at production level.

However, one side effect of this external inspection of salt at production level led the producer to push the higher average level of iodine content above 50ppm in order to avoid any lot of salt falling below 20ppm of iodine. This resulted in the high median urinary content in the range of 300µg/l based on the National Survey of 1999. Beyond the production level monitoring, the information reported from household or wholesale level has not been found to be as useful as the findings of the National Survey System, which has better assured quality.

4.1.7.3 The Salt Industry Quality Monitoring System

As part of the salt industry reform plan of the National IDD Elimination Program started in 1995, a quality assurance system was introduced for those facilities, which were licensed to produce salt for human consumption. This system required the monthly measurement of multiple salt quality indicators including iodine by qualified laboratories, which forwarded the report to the Production Monitoring Department of the China National Salt Industry Corporation.

The implementation of this system has been slow. By 1999, only half of the 118 production facilities were able to report the monthly results through the electronic network set up for this purpose. If this system is fully functional, it is an adequate internal monitoring mechanism for the salt industry system. At most production facilities, there is a local quality control mechanism to assure proper iodination by conducting daily iodine content measurement using the titration method for multiple samples. There is no requirement to report these results but there is an opportunity to make it a reportable system to strengthen the overall internal monitoring mechanism for the salt industry.

4.1.7.4 The IDD laboratory system

As part of the effort to establish the long-term monitoring capacity for IDD and iodized salt, a National IDD Reference Laboratory Network was developed through the support of AusAID and UNICEF starting in 1997 (Chinese Academy of Preventive Medicine 2001). **Table 3** summarizes the system and functional capacity.

The National IDD Reference Laboratory was established in 1997 and gradually emerged as a major laboratory support for staff training and the monitoring of IDD by the IDD laboratory network. The National IDD Reference Laboratory provides a proficiency-testing program for all laboratories in the China network–twice a year sending salt and urine samples for all laboratories to measure (Chinese Academy of Preventive Medicine 2001). Based on the reported results of proficiency testing, those laboratories with quality problems are followed up for remedial action. Another major service of the laboratory in recent years is to

Fig. 7. *IDD Day in Gansu Province (2000)*

assist other countries in training of personnel and the establishment of their national IDD laboratory capacity.

The most notable function of the Provincial Laboratory is the sample analysis from the biannual national IDD survey. Some provinces are able to carry out special studies in between the surveys, but for most provinces, other functions are limited due to funding constraints. To a large extent, under utilization is also an issue for the prefecture and local level laboratories. The notable exception is for those counties or prefectures where there are large scale salt production facilities. These laboratories are able to conduct monitoring testing monthly and can charge the facility for the inspection service.

4.1.8 The Communication and Health Promotion Effort to Support IDD Elimination

At the start-up of the National IDD Elimination Program in 1995, the health education and promotion component was planned as a major component of the program. The actual implementation of communication activities was limited during the First Phase of the national effort (1995-2000) mainly because the aim was to assure the supply of iodized salt through the reform and upgrade of the salt industry.

The primary task for IDD-based communication was managed by the Endemic Disease Department of the Ministry of Health (in 1998 it became a division of the Disease Control Department). The most notable effort, which brings national attention, is the annual IDD day on May 5 (Ministry

Fig. 8. *Logo for recommitment at National Re-advocacy Meeting 2000.*

of Health 2003). During this day, there are media and community-based events sponsored and supported by the public health agency throughout the country **(fig. 7)**.

Each year there is also a mobilization event held on the IDD day in one selected province where there was still significant IDD. The event is headed by a senior inter-agency team (health and salt industry) with international agency representatives to assure the participation of senior provincial officials.

The net result of replacing the non-iodized salt in the market with iodized salt through the re-establishment of a salt trade monopoly making only iodized salt available, in the short run, does not require a strong promotion effort directed to consumers. However, for those remaining areas where there is low use of iodized salt due to the abundance and lower price of non-iodized salt, the role of communication is critical– consumers must be convinced the more expensive iodized salt offers health protection and is better for the brain development of children.

4.1.9 Second Phase of IDD Elimination-2001 to Present

The achievement of the national goal of Universal Salt Iodization by 2000 for the entire country, as defined by the World Summit for Children, based on the major effort of the National IDD Elimination Program initiated in 1994 is now recognized as the First Phase of China's IDD elimination effort.

A high-level National IDD Advocacy Meeting took place in October 2000 where USI for the country as a whole was proclaimed and commitment was made to continue the IDD elimination effort for all provinces to reach USI by 2005 **(fig. 8)**.

This meeting became the defining event for the Second Phase of the IDD Elimination Program with a clear strategy, which required different input and effort from that for the First Phase.

The major goals for the Second Phase of National IDD Elimination Program were to assure:

1) the sustainability of the USI accomplishment of the First Phase; and
2) achieve USI for those provinces, which did not reach USI during the First Phase.

The rationale of having a strategy to sustain USI is based on other countries experience, which demonstrated that once the USI goal reached, further effort for IDD elimination or effort to assure the production and distribution of iodized salt begins to falter, and within a few years the iodized salt consumption level has dropped significantly. (see further Section VIII)

Even though at the national level, China was able to achieve 90% level of household salt consumption level this achievement was very uneven. Based on the 1999 National IDD survey, there were several provinces still far short from the USI goal, and it is apparent that each of these areas requires very specific action, aimed at the local situation, in order to achieve USI. These areas have not responded to the key intervention strategy of the First Phase–rapid scale-up of production and assured distribution of iodized salt through the reform of the salt industry.

4.1.9.1 Focus for the Phase 2 intervention-Characteristic of remaining IDD or non-USI areas of China

The remaining areas of China yet to reach USI have several features in common. These features can be summarized as the combination of two major factors:

1) excess local salt resource and supply resulting in lower cost salt available; and
2) the lack of an adequate iodized salt distribution mechanism and absence of a Salt Administrative Bureau to control the flow of non-iodized salt. The First Phase of the national program was able to establish an effective salt distribution and administrative mechanism in most parts of China, particularly in coastal and Central Provinces. But these systems are still far from complete in provinces in the remote Western Region.

Excess salt resource–the eastern coastal situation.

This problem is not uncommon across China because the richness of the salt resource far exceeds the annual salt requirement for human consumption and industry need. The centralized regulation of the salt trade, to a large extent, was able to stop the excess production and distribution of excess of non-iodized salt in most non-salt producing provinces. Hence the rapid achievement of USI in most provinces.

The major exception are coastal areas where there are excess salt fields with many small producers under local government protection because the salt fields are leased from local government and classified as township enterprises. In such cases, advocacy and communication to gain the interest of local government in supporting the IDD elimination task is important. This includes the removal of protection of those producing raw salt for human consumption and the assistance to salt farmers to transform the sea salt operation to other enterprises such as fishery or harvesting of seaweed.

Several provinces have already made great progress in this regard. The Jiangsu province has already eliminated 90% of excess salt fields and was still able to achieve USI status for the entire province by 2000. Fujian province has eliminated over 20,000 hectares or two-thirds of the excess salt fields since 2000 and reached the USI status in 2002. The experience of Fujian demonstrated the important role of a provincial governor in “influencing” the county authorities to support the IDD elimination effort by abandoning their protection of excess raw salt protection.

Hainan province is the only coastal province that does not have an active program to eliminate or to transform the excess salt fields. This in part reflects the lack of understanding of the provincial leader of the significance of IDD, and in part due to a weak salt administrative system and provincial salt company only willing to focus on salt distribution to areas which have higher profit margins. For the most part, in the coastal areas the primary problem is excess raw salt, which is cheaper than the iodized salt. There is no shortage of iodized salt supply. In such a scenario, the successful experience of eliminating excess salt production capacity through gaining the support of local government is the key. Consumer education and health promotion is critical in accelerating this effort.

Excess salt resource coupled with lack of access to iodized salt–the Western inland situation.

In the western inland of China, there are also abundant salt resources, and to a large extent harvest by local salt traders. Because of low population density and vast distances from government sanctioned large salt producers, the distribution network for iodized salt is incomplete and lacking in the vast areas of western China, especially Tibet, Qinghai, and Southern Xinjiang. This combination creates the greatest challenge of IDD elimination.

The general strategy in such a setting is to establish iodized salt distribution first. This can be accomplished by subsidizing such higher cost operation with profits from urban areas. The Xinjiang Salt Corporation is a good example of such effort. It set up local salt distribution centers in Southern Xinjiang, which previously had no history of iodized salt use. Once the access point for iodized salt was established, the second step was to promote the importance of iodized salt through various channels–education, religious, and mass media. To a large extent, this effort has been supported by international agencies, such as UNICEF.

The only major challenge remaining is that the difference in cost of locally collected raw salt and the processed iodized salt can often be great. In most remote areas where income level is far lower than the urban areas, a significant cost differential still presents a barrier to access to iodized salt. Without some form of short-term subsidy in the form of a government poverty alleviation fund or below-cost support on the part of the overall profitable salt company system, it will be difficult to achieve the USI goal in some of the remote areas. The role of enforcement of the Salt Administrative Bureaus in these western remote areas is limited because they are only useful in stopping large-scale illegal production and distribution. In remote areas, most of the salt collection and distribution is done by very small-scale traders or through self-collection at the local salt deposit. A feasibility study in a large part of Western China, on how best to achieve access to iodized salt, by making it affordable, is clearly indicated.

Table 4. *Median Urinary iodine in target groups (µg/L)*

Target groups	Urinary Iodine
School Children (8-10 years)	229.1
Women at child bearing age (20-40 years)	220.2
Pregnant women	178.8
Lactating women	191.3
Babies (0-2 years)	240.4
Milk	145

4.1.9.2 The role of advocacy and communication

During the Second Phase of the China IDD Elimination Program, the role of adequate communication and health promotion is far more important than during the First Phase. The major challenge of the Second Phase is the remaining areas, which did not reach USI, and these are areas where there is significant competition between iodized salt and the often-cheaper

Fig. 9 *The logo selected from a national competition intended for application with communication material for marketing of iodized salt to consumers through the salt companies. The Chinese Characters state "Iodized salt protects the intelligence of Children". The symbol of 'tree' has special meaning in China; it implies raising children is like growing a tree, which requires special care to assure good development.*

non-iodized salt. For consumers to choose a more expensive salt, they must perceive the added value for health and protection of children's intelligence worth the extra cost. Hence it is essential to market the added value of iodized salt.

Historically, this has been the role of the health education and promotion specialist in China. The salt industry or provincial salt company has played little role in this regard because of the monopolistic nature of the salt company in each province where due to the lack of a major competitor, and a remote market makes a profit unlikely. Given the monopoly status of the Salt system of China is mandated as an instrument for IDD elimination, it is essential for the now profitable salt industry to assure not only distribution of iodized salt to remote areas, but also to market the iodized salt to promote the choice over non-iodized salt. In this connection, the network of 750,000 licensed salt retailers will be mobilized to undertake IDD education with consumers, since they are in direct contact with the users of salt on a regular basis. Without a marketing effort, it will not be possible for rural and poor consumers to purchase the more expensive iodized salt over the raw salt. Since 2001, through the support of the China National Salt Industry Corporation and UNICEF, there is increasing effort by some of the Provincial Salt

Corporations to invest in marketing of iodized salt to consumers. In 2002, a competition was set up to develop a logo, which can be used in future communication and promotion efforts on the importance of iodized salt to consumers **(fig 9)**.

Beyond the health promotion effort to consumers, advocacy effort to assure local government support to support and to sustain IDD elimination is also part of the Second Phase of the National Program. High-level remobilization events were held in September 2001 and in October 2003. The later event was organized as a joint national and international meeting with high-level participation from 20 countries and senior officials from all provinces in China yet to reach the USI goal. The focus of this event was to showcase the feasibility of IDD elimination in difficult areas to stimulate greater action and political support.

In essence, continuing advocacy will help achieve IDD elimination in remaining non-USI areas, and equally important, to help sustain the USI in areas already achieved.

4.1.9.3 The Role of monitoring and surveillance

The well-established National IDD Survey mechanism during the First Phase of the National IDD Elimination Program continues to be of great value for the Second Phase in order to monitor progress in areas yet to reach USI. Additionally, it has become a quality assurance tool for those areas, which have already achieved USI–for the detection of relapse. In fact this later function has proven of be useful in the 2002 National IDD survey where there were several areas, such as Beijing and Yunnan province as a whole that were found to fall below the previously achieved level of 90% iodized salt coverage defined for USI. The same survey mechanism was also able to identify the pockets within these two provinces where there was significant use of non-iodized salt. As a result, in-depth assessment and IDD elimination action has been put into action with the support of UNICEF.

One major adaptation of the National IDD survey system during the Second Phase is the expansion to measure iodized salt coverage from province level to that of sub-province level (prefectures). In doing so, it eliminated the need for a secondary survey to determine the problematic areas with below 90% coverage within a given province.

Fig. 10 illustrates the iodized salt consumption level of Beijing based on the 2002 National Survey. This not only detected that Beijing had a significant relapse from its previous level of 95% in 1999 to 89% in 2002. With this finding, the Beijing Salt Corporation was able to determine that

**Non-iodized salt consumption level -
Beijing Municipality**

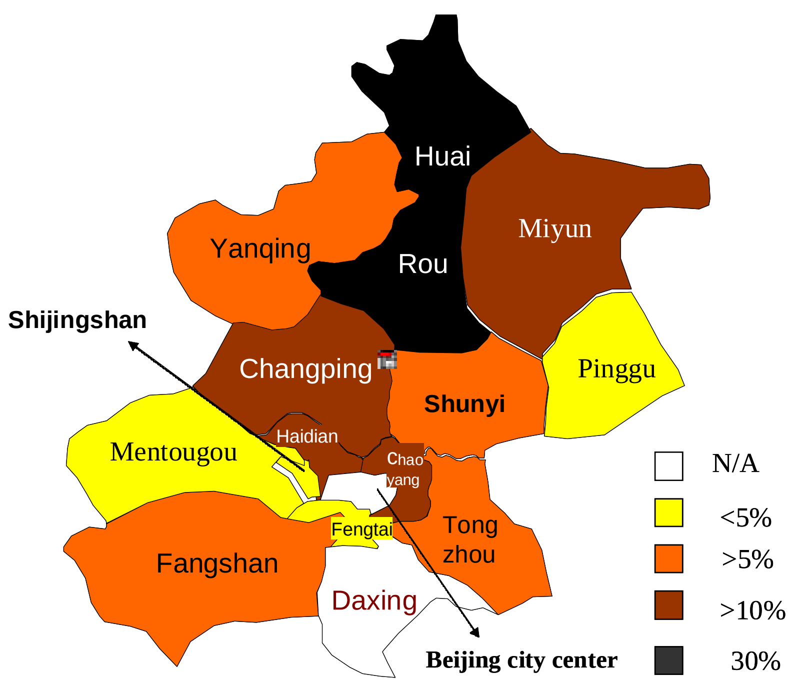


Fig. 10. *Beijing-data The 2002 National IDD survey found the Municipality of Beijing which had previously reached 95% iodized salt consumption level had declined to 89%; hence no longer meeting the USI definition. The 2002 survey was able to provide below province monitoring, and so was able to determine that three of the northern Beijing counties now have very high levels of non-iodized salt use. This became the focus of further investigation and intervention by both salt and health authorities. This is an example of the value of long-term monitoring.*

there was a major loophole in the wholesale system with penetration into the rural areas of the Beijing municipality of non-iodized salt as well as unauthorized salt. Remedial action was initiated in the summer of 2003.

The 2002 National Survey was able to demonstrate that, most of the remaining non-USI provinces in the First Phase of the National Program, based on the 1999 National survey had made significant progress, except for Tibet. Fujian and Ningxai provinces reached provincial USI since last survey. The value of this system for both problem detection and monitoring of progress is clearly established. The most valuable aspect of this system is the fact that it has become the main management tool of the National IDD Elimination Program where the findings are used to determine program action and funding priorities. For sustained action, including the maintenance of already achieved USI, the China National IDD Survey demonstrated the usefulness and cost effectiveness of investment in a quality surveillance system.

4.1.9.4 National Investigation on Iodine Nutrition of Special Target Groups (2002)

An important project concentrated on the iodine nutritional status of the major target population (women of childbearing age, pregnant and lactating women) jointly supported by MOH, Salt Industry and ICCIDD. ICCIDD Focal point, Prof. Yan Yuqin organised 12 teams to implement this project for understanding the iodine nutritional status in the target population after USI. 26 clusters of populations in urban and rural areas from 12 provinces were selected for this survey. Schoolchildren at age of 8-10, women of child bearing age (20-40 years old), pregnant women, lactating women and their infants or babies at age of 0-2 years old were regarded as target groups.

The mean iodine concentration in drinking water was 3.7µg/L (n=1290), which indicates the environmental iodine deficiency. The coverage rate of USI was around 97%. **Table 4** shows the urinary iodine concentration in target groups with data on milk iodine.

The survey also demonstrated that UI in pregnant and lactating women in some of rural or urban areas was below 150 or even 100µg/L, which reveals mild iodine deficiency is still present even though they have adequately iodized salt.

The results reveal the following facts:

- There is adequate iodine nutrition in all the special target groups and there is no iodine excess.

- The newborns are completely protected by sufficient iodine intake. Recommendations were:
- The iodine nutrition in pregnant and lactating women should be given special attention to ensure the urinary iodine of young children is over100 but below 150µg/L after the intervention of USI.
- Urinary iodine in schoolchildren should not be below 150µg/l.

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4.2

Tibet

Creswell J Eastman and Mu Li

4.2.1 Introduction

The very mention of the word Tibet conjures up visions of mountains, mysticism, religion and spirituality and provokes strong rhetoric and robust debate about human rights and independence. Because of its geographic and political isolation, Tibet remains a land wrapped in obscurity and controversy, about which facts and reliable information are sparse, but propaganda is plentiful and opinions abound. In the masses of material published in the international press dealing with the plight of the Tibetan people, we have been struck by the scarcity of any reliable information on the health status of the people living in Tibet. The purpose of our report is to bring to the attention of the international medical community, the widespread prevalence of iodine deficiency disorders (IDD) in Tibet and the devastating consequences IDD has had on the physical and intellectual development of the population. We provide previously unpublished information on preliminary outcome data from an ongoing Australian-funded and WHO-supported intervention, designed to eliminate this scourge from future generations of Tibetan children (Li & Eastman 2003).

4.2.2 Definitions and Demographic Data

By Tibet, we mean the Tibet Autonomous Region (TAR), a province of the Peoples Republic of China (PRC). The TAR is a high altitude plateau, averaging 4000 metres above sea level, encircled by the highest mountain ranges on earth and covering a huge landmass in excess of 1.2 million square kilometres. It is a sparsely populated environment, subjected year round to harsh extremes of climate. Basic infrastructure is very limited, particularly in roads and transport. There are no internal rail or air services. The TAR comprises 7 prefectures that are further subdivided into 73 counties. The total population is approximately 2.5 million, with 70% living in rural and remote areas. Official statistics claim that 90% of the permanent population is ethnically Tibetan, the remainder being Han Chinese and some minority ethnic groups. Large numbers of ethnic Tibetans live in the surrounding provinces of Qinghai, Gansu, Sichuan, Yunnan and Xinjiang where IDD continues to be a significant problem.

The TAR economy is heavily subsidized from Beijing and domestically relies mainly on agriculture and herding or animal husbandry, with the majority of the population being engaged in agriculture. The nomadic people, who reside in the more remote areas of the country, largely undertake herding of yaks, sheep and goats. The average per capita income of approximately US$120 indicates a severe level of poverty. More than 50% of the adult population is illiterate, with the highest rates being in the older rural populations (Zhang Tianlu 1997). One can only speculate that this high level of illiteracy is a consequence of multiple factors including lack of educational opportunity and minimal educational resources, combined with the effects of IDD and other micronutrient deficiencies on intellectual development.

4.2.3 Major health problems in Tibet

Life expectancy is lower and infant mortality is higher in Tibet compared with the rest of China (Hayes et al 2001). Infectious diseases and endemic nutritional disorders dominate the health profile. IDD and Kashin-Beck disease (KBD) are the two highly prevalent non-communicable endemic diseases. KBD, also known as "big bone disease", is characterised by a deforming osteoarthropathy resulting in decreased limb length, shortness of stature and severe disability. The aetiology of KBD remains obscure. Putative causes include dietary selenium deficiency and mycotoxin poisoning by fungal contamination of stored barley (Chasseur et al 1997). It is interesting that IDD and KBD coexist in many regions in Tibet such that iodine deficiency has also been implicated in the pathogenesis of KBD (Moreno-Reyes et al 1998).

In a recent multicultural and comprehensive study of nutritional and health status of Tibetan children from 0 to 7 years of age, Hayes and colleagues reported that 51% of the children were stunted in growth (Hayes et al 2001). Undoubtedly IDD is a major contributory factor to growth retardation.

4.2.4 IDD in the Peoples Republic of China (PRC)

Endemic environmental iodine deficiency occurs in most, if not all, of the 31 provinces and autonomous regions of the PRC and it is estimated that over 500 million people live in areas of moderate to severe iodine deficiency. The history of IDD in the PRC and the successful national IDD elimination program have been well described elsewhere (Wang et al 1997; Eastman 1997) and Section VIII of this book. Universal Salt Iodization (USI), underpinned by legislation that all salt destined for human and animal consumption must be iodized, was the vehicle chosen to deliver iodine to the human and animal populations. A countrywide public health promotion and education campaign has succeeded in creating a high level of awareness of IDD in the population and this has driven the demand for iodized salt. A World Bank review of the NIDDEP in 1998 concluded "there

Fig. 1 *Tibetian lady with large goitre*

has been excellent progress and quite remarkable achievements in the efforts to eliminate IDD in China through implementation of the NIDDEP" (World Bank 1998). The report found that an effective, nationwide, program management and operational structure was in place for social mobilisation, health education and surveillance, from county through provincial to national level, and was functioning well with some notable exceptions in some of the poorer more remote provinces. Tibet was the most notable outlier.

4.2.5 IDD situation in Tibet

Information discussed in this communication has been derived from the Tibet Department of Health (TDOH) through surveys performed by the Tibet Institute of Endemic Diseases Prevention and Control (TIEDPC), the biennial National Surveillance Studies conducted in 1997,1999, 2001 and field studies performed in Tibet by the authors (Eastman et al 1999). In the 1997 survey, conducted in all seven prefectures, only 22% of the population surveyed had urinary iodine excretion concentrations (UIE) above the cut-off level of 100ug/l, that is consistent with adequate iodine nutrition (**Table 1**). More importantly, 35% of the population exhibited severe iodine deficiency (UIE <25µg/L) and 43% exhibited moderate to mild iodine deficiency (UIE of 25-100µg/L). Data obtained during the 1997

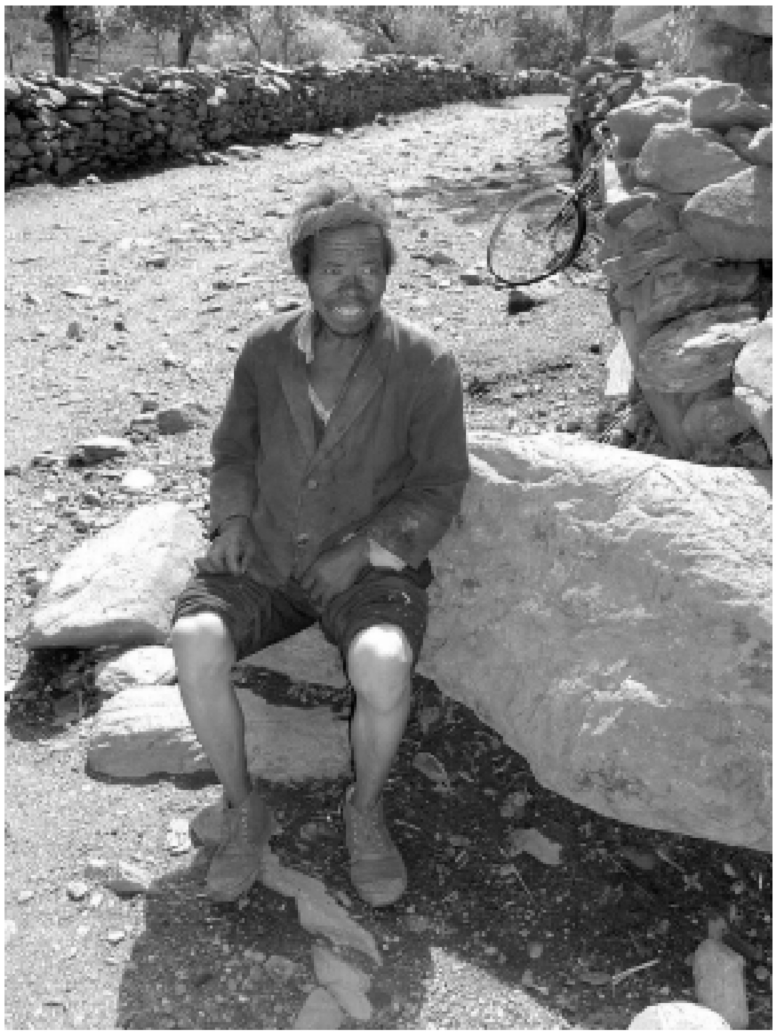


Fig. 2 *Cretin with Kashin-Beck disease*

Fig. 3 *Stunting of growth*

Table 1. *Distribution of Urinary Iodine levels in the Tibetan population prior to commencement of Tibet IDD Elimination Project**

	Distribution of urinary iodine levels (% of population studied)		
Prefecture	**0–25μg/L**	**25–100 μg/L**	**>100μg/L**
Lhasa	14.4	48.1	37.5
Changdu	47.5	38.3	14.2
Shannan	16.5	58.2	25.3
Rikazi	64.5	28.3	7.2
Nakchu	28.1	37.2	34.7
Ali	5.1	74.4	20.5
Linzhi	12.0	58.9	29.1
Totals	**34.8**	**43.3**	**21.9**

Data provided by Tibetan Institute of Endemic Diseases, Prevention and Control (TIEDPC) from large-scale population study performed in 1997.le 2**: 1995,1997 and 1999 China National IDD Surveillance Survey data*

Table 2. *1995, 1997 and 1999 China National IDD Surveillance Survey data*

	Tibet			**National**	
	1997	1999	1995	1997	1999
Households qualified Iodized Salt coverage	6.2	27.5	29.7	69.0	80.6
8-10 y-o TGR (by palpation)	29.0	22.8	20.4	10.9	8.8
8-10 y-o median UIE	55.4	58.8	164.8	330.3	306.0

Data is presented as % of the population sample studied

TGR: Total goitre rate

and 1999 National Surveillance Studies for goitre rates, median urinary iodine levels, household iodized salt rates (aggregated for the whole of Tibet) are shown in **Table 2.** There is data from IQ studies of a sample of approximately 4500 children showing an average IQ of 85. Cretin rates quoted by the Tibet Department of Health in 1999 ranged from 2.0% to 13% in rural villages where iodine deficiency was known to be severe. There is no independent data available to corroborate these IQ figures and cretin rates.

We do not have any original data relating to physical growth and development of Tibetan children. Recently, Hayes and her colleagues studied 2078 Tibetan children, 0 to 84 months of age and found 51% had moderately or severely stunted growth (Hayes et al 2001).

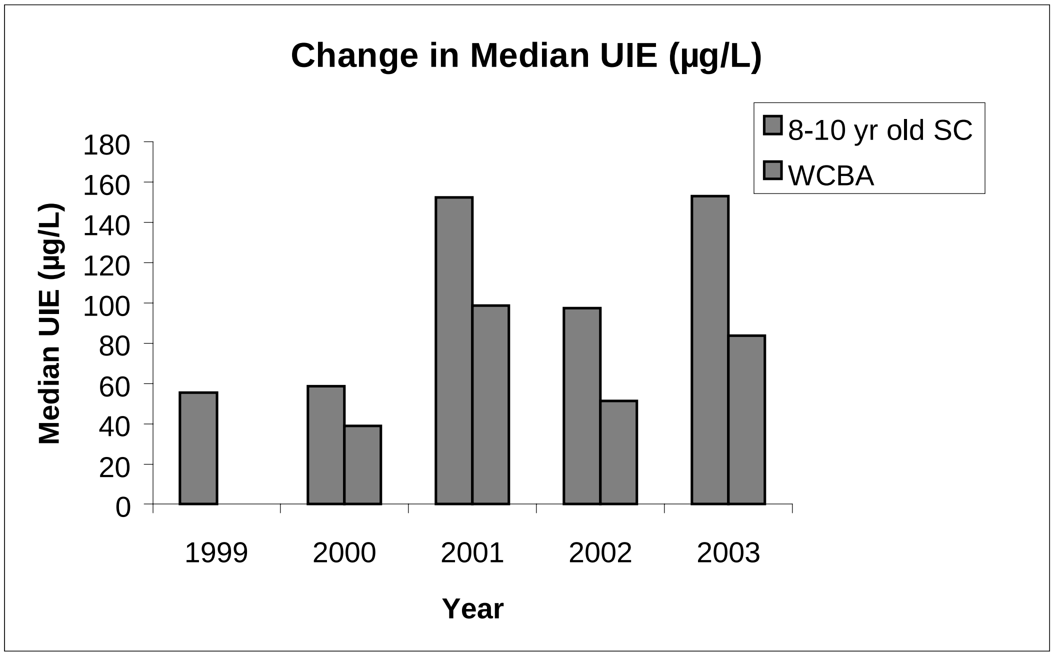
4.2.6 IDD Elimination Efforts

Measures to control endemic goiter in Tibet were first initiated in the 1970s. At that time the causal link between endemic goiter and neurological impairment was not understood, consequently these preventative efforts were not very successful. Iodized oil capsules have been distributed sporadically among the population since 1993. In addition there was an initiative undertaken to fortify “brick tea” with iodine, but this was not successful.

An iodizing salt production facility was established in Lhasa in 1998 and in the first year produced 2500 tonnes of iodized salt. The major obstacle to USI is the wide availability of cheap, raw salt harvested from the mountain lakes and bartered for barley and other foodstuffs.

4.2.7 IDD Elimination Project in Tibet

In 1999, with support from WHO, AusAID and UNICEF, we undertook a feasibility study for the development of a whole of Tibet IDD elimination program (Eastman et al 1999). The recommendations from the Feasibility Study were accepted and implemented with financial support from AusAID and WHO. The program comprised support for the development of an iodized salt industry, health education and communication, training, capacity building, management support and the implementation of a short-term iodized oil capsule supplementation campaign. The goals and components of this project have been described in detail elsewhere in 2003 (Li & Eastman 2003). The iodized oil capsule distribution program was implemented as a short-term or interim solution to prevent brain damage and growth retardation in the newborns and infants while USI was being phased in.



WCBA: women of childbearing age

Fig. 4 *Changes in median Urinary Iodine Excretion (UIE) since commencement of the Tibet IDD Elimination Project in 1999-2000.*

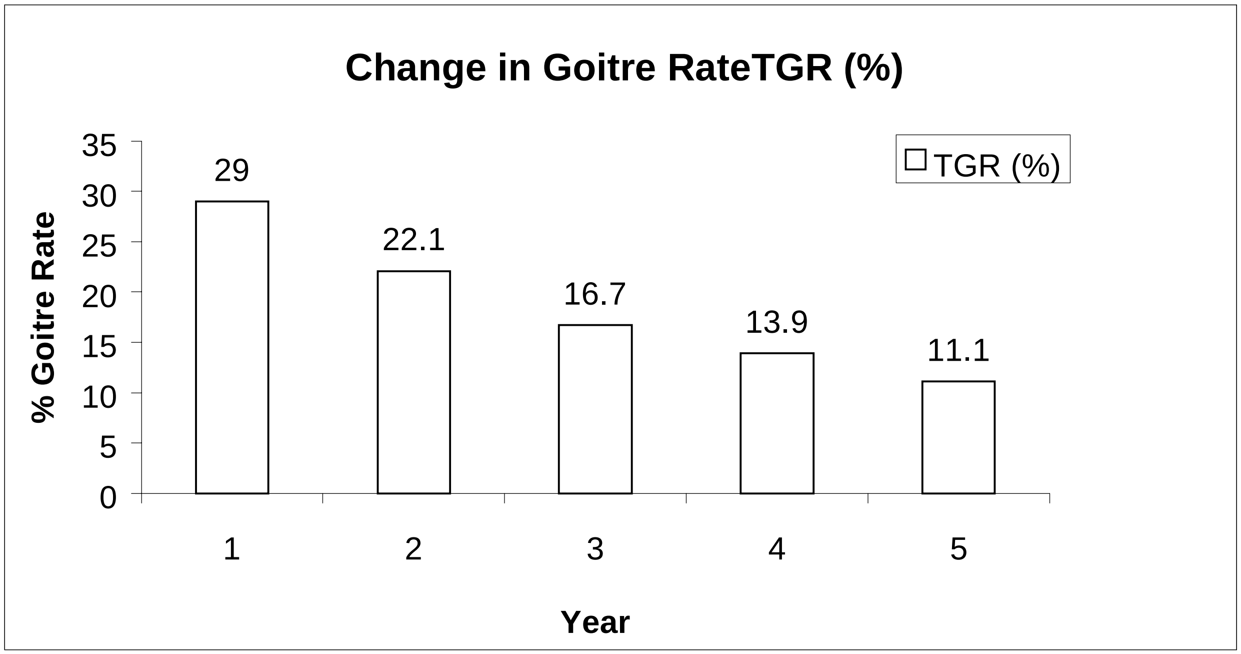


Fig. 5 *Changes in goitre rate in Tibetan children since commencement of the Tibet IDD Elimination Project in 1999-2000 (year 1)*

4.2.8 Outcomes of the IDD Elimination Project

The Lhasa salt factory has increased production of iodized salt to 5500 tonnes in 2003. This represents approximately 40% of the iodized salt required for human consumption for the population of Tibet indicating that there is a long way to go to achieve USI in Tibet. Nonetheless, dramatic progress has been made since 1999 as median UIE in both children and women of childbearing age have now increased to 143µg/l and 82µg/l, respectively **(fig. 4)**. There has been a concomitant decline in the goiter rate in children from 29% to 11% **(fig. 5)**. The challenge is how to sustain this great gain in the fight to eliminate IDD in Tibet.

4.2.9 Discussion

IDD is endemic throughout the whole of the TAR and there is unequivocal evidence for widespread physical and intellectual impairment among the children of Tibet. While we suggest that iodine deficiency is the major determinant in this process, many other factors may be incriminated in stunting the physical and mental development of these children (Maberly & Sullivan 2001). Notwithstanding these various possible contributory causes, severe iodine deficiency is universal throughout rural Tibet and is associated with a high prevalence of goiter, endemic cretinism, diminished IQ and growth retardation. The TDOH quotes prevalence rates from 2% to 13% in rural villages surveyed. While we have no means of verifying these figures our impressions from visiting and surveying the population of eastern and southern Tibet are that endemic cretinism is very common, as is KBD (Li & Eastman 2003; Eastman et al 1999). In the recent study of children and adolescents with KBD, performed in villages around Lhasa, approximately 1% of these children had classical signs of endemic cretinism (Moreno-Reyes 1998). In this study 66%of the population were severely iodine deficient with a urinary iodine excretion level less than 20ug/l and a goitre prevalence of 46%.

4.2.10 Conclusion

The IDD elimination project commenced in year 2000 has demonstrated great gains in educating the population about the human damage caused by iodine deficiency and the need to supplement the population with iodine. All efforts are now being directed towards ensuring these initiatives will be sustainable.

Acknowledgements

We thank AusAID officers in Canberra and Beijing, WHO/WPRO staff in Manila, ACCIDD personnel, health officials in the Ministry of Health in Beijing and our Tibetan colleagues for their great efforts and support.

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4.3

Mongolia

ZP Chen

Mongolia is located in the north of China with a population of 2.2 million, an area of 604,000 square miles and average altitude of 1600 meters. There are 21 provinces and the city of Ulaanbaatar is the capital with a population of 600,000), IDD is a public health problem, with goitre prevalent in most of the country. Cretinism is only found in Bulgan in Central Mongolia with the incidence of 0.4% and the hypothyroid type is predominant. The investigation indicated environmental iodine deficiency, i.e. iodine concentration in water is only 0.24-4g/L. An iodized oil program was carried out in most of provinces, which was supported by UNICEF. A National Advocacy Meeting was held in 1995. A National IDD Control Program was established and USI became the major strategy for IDD elimination. The Public Health Institute of Mongolia was appointed as the executive technical body for the implementation of National IDD Control Program.

There are 12 salt companies for the production of iodized salt, of which half are state-owned. Iodine concentration at production level is 50ppm with 20-30ppm at consumer level. However, a large amount of the salt in Mongolia is imported from abroad of which 25-37% is iodized salt with the concentration of 40ppm for human consumption. Potassium iodate will have been supported by (Japanese International Cooperation Agency (JICA) by the year 2000 through a cooperation project. Up to now there is no report on Iodine Induced Hyperthyroidism.

The price difference between iodized salt and crude salt is great (crude salt 75 Tuclic/kg; iodized salt 200-500 Tuclic/kg). Only 42% of the population is covered by iodized salt, therefore, IDD is still prevalent in Mongolia. A JICA Project helped to set up a laboratory for urinary iodine determination in Ulanbaator with support for training and monitoring. There is no strict monitoring system for iodized salt and only the rapid kit has been used for random monitoring. Another problem is there is no effective ban on non-iodized salt in the market.Further progress can be anticipated with the continued support of JICA.

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4.4

Democratic People's Republic of Korea

ZP Chen

IDD in DPR Korea is a significant public health problem. However, the severity of IDD is not so severe as in other parts of Asia, because Koreans have seafood as a traditional dietary habit for thousands of years. In particular seaweed is quite common as table food for pregnant and child bearing aged women. Endemic goitre is found in some places, especially in mountainous areas.

Iodized salt is the main strategy for IDD elimination and relative sectors of the government have adopted salt iodization and promote the consumption of iodized salt. The total need of salt for human consumption is 40,000 tons/year, but only one-fourth is iodized. Since the floods the economic situation has been getting worse and salt pans were severely damaged. Some salt was then imported from China with the support of UNICEF to meet the urgent need.

Mr. Lorenzo Locatelli-Rossi (ICCIDD) visited DPR Korea in 1998 and two training workshops on "Universal Salt Iodization in DPR Korea" were organised. He suggested a plan of action focused on rehabilitation of salt works to increase the production of iodized salt.

5

IDD in the Asia Pacific Region: Progress and Problems

Creswell J Eastman

5.1

Summary and Lessons Learnt

Creswell J Eastman

The goal of achieving USI and virtual elimination of IDD, within the Asia Pacific region by 2005 remains a formidable challenge for many countries. Unless IDD efforts and programs can be reinvigorated in a number of countries, where there has been little or no progress in recent years, the goal is not attainable. The commitment and achievements in countries such as Thailand, Indonesia, and more recently Vietnam, provide inspiration to others that sustainable IDD elimination can be realised throughout the Asia Pacific region.

5.2

History and Background

Creswell J Eastman

Iodine deficiency still exists as a major public health problem in a large number of countries in the Asia-Pacific region. The vast geographical expanse of the Asia-Pacific region, covering approximately 40 countries, from tiny Pacific Islands nations to some of the most populous nations on earth, such as Indonesia, poses a challenge in identifying and addressing the problems of IDD in this part of the world. Because many of these countries are island states with large expanses of coastline, and presumably with access to seafood, it has erroneously been assumed that iodine deficiency was not a significant endemic problem. As a consequence, there is little or no data on IDD in many of the smaller nations and a disregard for the crucial role of iodine nutrition in some of the more affluent nations such as Australia and New Zealand. ICCIDD has shown a commitment to address this issue by establishing a new region and appointing a new regional coordinator for the Asia-Pacific region in 2002.

The best source of information on IDD prevalence data comes from the WHO Western Pacific Regional Office (WPRO) in Manila (WHO 2004). In the Western Pacific Region nine countries (Cambodia, China, Mongolia Laos, Malaysia, Papua New Guinea, Philippines, Vietnam and Fiji) have IDD as a significant public health problem. Hong Kong has also been recently recognised as having mild iodine deficiency. There have been reports of goitre being prevalent in New Caledonia, Fiji and some of the other smaller Pacific Islands. However, survey data is limited and these reports will need to be investigated. It is likely that IDD is a significant public health problem in East Timor, as there are many anecdotal reports of endemic goitre in adults and children in the hinterland of this emerging island state. Of major concern are recent reports of the re-emergence of iodine deficiency in Australia and New Zealand (Li et al 2001; McDonnell et al 2003). On the other hand, there are some shining examples of success in controlling IDD within the region, most notably Thailand and Indonesia whose stories will be recounted elsewhere in this book. The available data on household coverage with adequately iodized salt, on a country-by-country basis, indicate that Cambodia and the Philippines are lagging well behind other countries in the region **(fig. 1)**. Data provided by UNICEF. It should be emphasised that data is not available for many countries in the region.

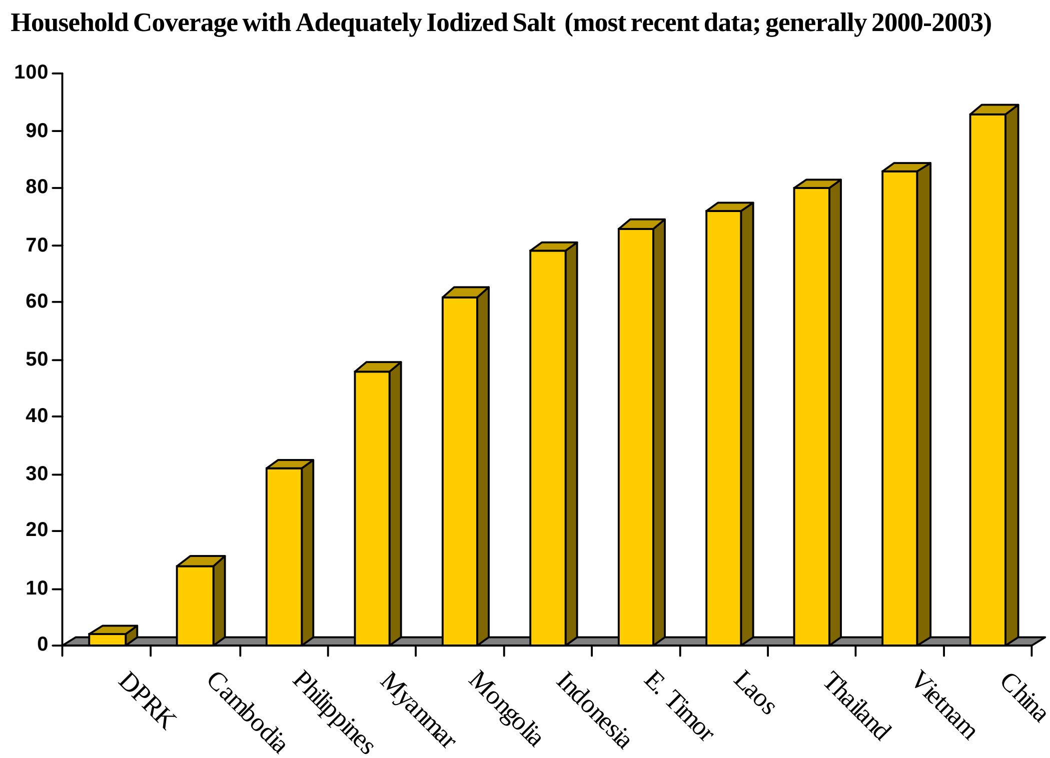

Fig. 1. *Household coverage with adequately iodised salt in countries in Asia Pacific region. This data has been collected from 2000 to 2003 and is provided by courtesy of Karen Codling, EAPRO, UNICEF.*

5.3

Regional Activities

Creswell J Eastman

5.3.1 Australia and New Zealand

5.3.2 Cambodia

5.3.3 Laos

5.3.4 Malaysia

5.3.5 Papua New Guinea

5.3.6 Philippines

5.3.7 Vietnam

5.3.1 Australia and New Zealand

Several recent surveys have confirmed the re-emergence of mild iodine deficiency in Australia (Li et al 2001; McDonnell et al 2003). Median urinary iodine excretion (UIE) levels have decreased from over 100 ug/l, in surveys conducted before 1990, to levels around 80ug/l, in surveys conducted a decade later. This dramatic decline in iodine intake in the Australian population has been attributed to the major decrease in iodine concentrations in dairy milk (Eastman 1999). For several decades the major source of iodine in the Australian diet has been from contamination of milk by iodophores used as sanitising agents in the dairy industry. These chemicals have gradually being phased out and replaced by chlorine-based disinfectants. Because Australia has not had an ongoing monitoring program the problem only came to light through the efforts of researchers interested in IDD. While iodized salt is readily available in most grocery stores and supermarkets, sales of iodized table salt represent less than 10% of the edible salt market in the country. There is no legislation compelling the use of iodized salt in the food industry and there is little awareness among the public of the problems of IDD. The situation in New Zealand is very similar to that in Australia. Both countries share a common food standards authority so any changes to legislation regarding salt iodization will need to be agreed between them before we can expect change.

A National Iodine Nutrition Study is presently underway in Australia to obtain a snapshot of urinary iodine levels and thyroid size in 8 to 10 year old schoolchildren to provide data for the development of a sustainable, comprehensive program for optimal iodine nutrition.

5.3.2 Cambodia

Cambodia still has a major problem with IDD. Iodine deficiency is quite severe throughout the country. A national subcommittee for control of IDD was formed in 1997 and at that time a national goitre survey was undertaken. The national goitre rate has been reported as 12 percent but in some provinces it is as high as 39 percent (UNICEF 1997). Legislation for USI was introduced in 1998 and salt iodization commenced in 1999 with assistance from WHO and UNICEF. There are a number of local salt producing and iodization plants, but in the eastern border areas most salt comes from Vietnam. Much of this appears to be non-iodized salt. Recent data on household coverage with adequately iodized salt indicate that the program to provide USI has stalled **(fig. 1)**. The Ministry of Health in

Cambodia continues to provide iodized oil capsules to people living in remote areas. There are many ongoing community activities for education and social mobilisation promoting the use of iodized salt. Many problems still persist and there is an urgent need to provide Cambodia with more assistance to achieve sustainable IDD elimination.

5.3.3 Laos

IDD has long been recognised as a major public health problem in Laos and was confirmed by the national iodine survey in 1993 that revealed iodine deficiency was almost universal throughout the whole country. 65% of children examined were classified as having severe iodine deficiency. The legislation for USI was introduced in 1995. With financial support from UNICEF local salt producers commenced iodizing salt. Most of the 26,000 tonnes of edible salt produced annually in Laos is now iodized. A goitre survey undertaken in 2000 confirmed that the goitre rate in children had declined from over 50% to only 10%. Despite this great improvement a recent review of the salt industry in Laos commissioned by UNICEF (Locatelli Rossi 2003) unearthed major faults in the production of iodized salt that may explain why iodized salt tested at the household level is frequently inadequately iodized. Resources from WHO, UNICEF and ICCIDD have been mobilised to assist Lao government authorities address the deficiencies in their IDD elimination program.

5.3.4 Malaysia

IDD has been identified as a significant public health problem in various geographic regions of Malaysia, particularly in interior population groups in Sarawak and Sabah (Goek Lin Khor). While there has been legislation since the 1980s that all imported salt be iodized it is not known if this has eliminated IDD from Malaysia.

5.3.5 Papua New Guinea

Severe iodine deficiency was identified in PNG in the 1950s and it was the site of the pioneering clinical research of Pharaoh and Hetzel and their colleagues demonstrating that neurological cretinism could be prevented by the administration of iodine early in pregnancy. While legislation was enacted in 1995 banning the importation, sale and distribution of non-iodized salt the lack of a national monitoring program means there are no recent data to indicate the current status of IDD in PNG.

5.3.6 Philippines

Iodine deficiency continues to be a significant public health problem in the Philippines and iodized salt utilization remains very low. Approximately two-thirds of the children recently surveyed in 1998 and 2001, by means of urinary iodine excretion, in the Philippines had significant iodine deficiency as shown in (IDD Newsletter Feb 2004 page 17). Despite all of the efforts that have gone into eliminating IDD from the Philippines, commencing in the early 1980s and continuing up until now, iodine deficiency remains highly prevalent throughout the whole country.

Table 1. *Prevalence of iodine deficiency by urinary iodine excretion levels in the Philippines: data provided courtesy of Karen Codling, UNICEF*

Prevalence of IDD in the Philippines
1998 Survey - urinary iodine levels • Median UIE = 71µg/L • 34.7% = >100µg/L (no IDD) • 29.6% = 50 -99µg/L (mild IDD) • 23.5% = 20-49µg/L (moderate IDD) • 12.3% = <20µg/L (severe IDD)
Comparison : UIE < 100µg/L (Children with IDD) • Philippines: 65.4% • Vietnam: 39.2% • Laos: 27.45%

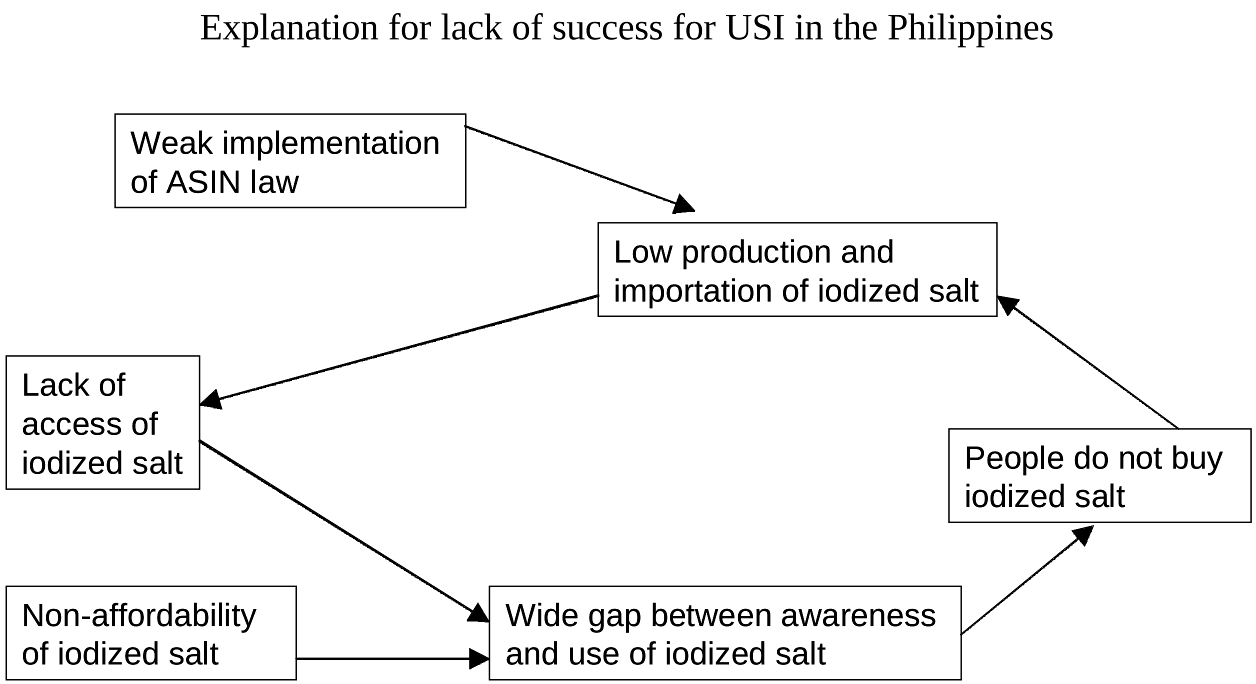

Fig. 2 *The reasons for the Philippines not succeeding in eliminating IDD are multiple and are summarised.*

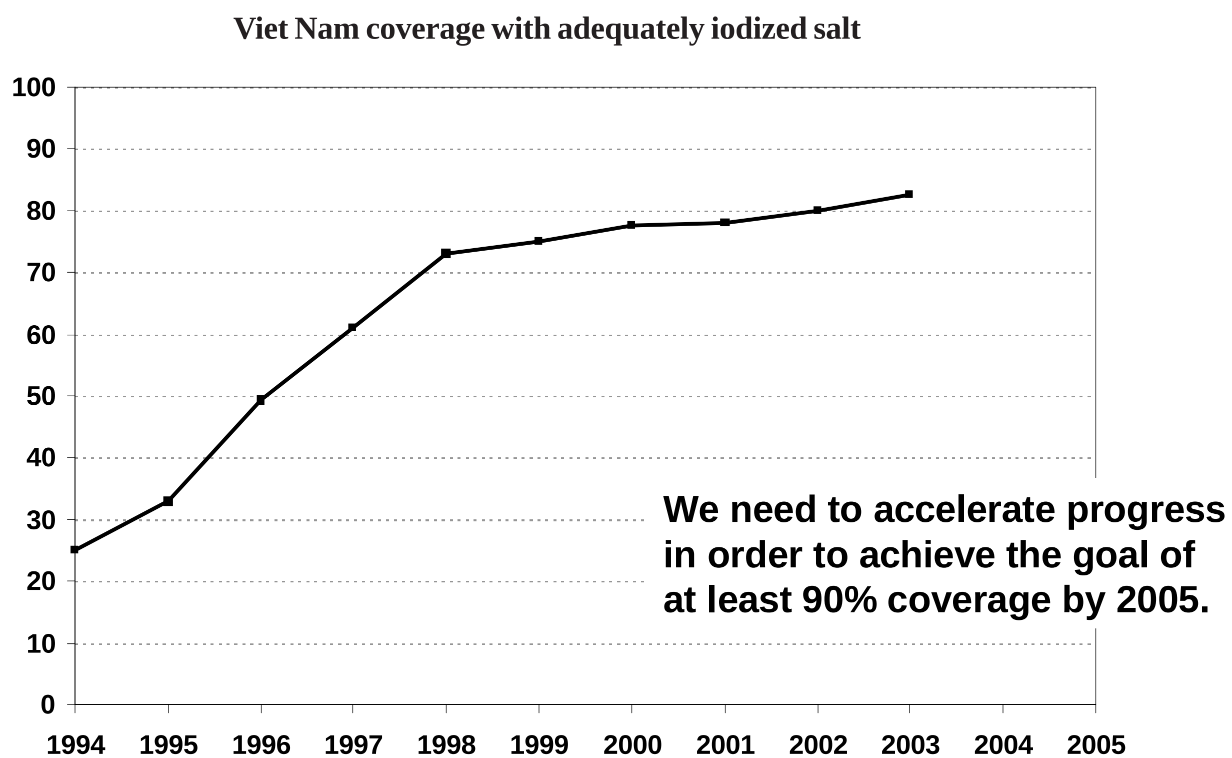

Fig. 3. *Shows the progress Vietnam has made towards achieving the target of USI*

In 2003, new initiatives were developed and instituted to accelerate progress to achieve the goal of USI. These efforts have been spearheaded by the Department of Health and supported by UNICEF, Kiwanis and ICCIDD. There is renewed optimism that strengthening and enforcing the law on salt iodization will see progress in the effort to eliminate IDD. The reasons for the Philippines not succeeding in eliminating IDD are multiple and are summarised **(fig. 2)**.

5.3.7 Vietnam

The first IDD control programs in Vietnam were established in the early 1970s. The initial focus was on the mountainous provinces in the North where goitre rates were as high as 55%. A nationwide survey was undertaken in 1993 and the average goitre rate in children was 22% and the median urinary iodine excretion was only 32µg/L. The government of Vietnam responded by establishing a national IDD control committee and developed a nationwide network of salt iodization plants. AusAID provided technical and other assistance to assist in establishing this program. In 1999 the government issued a decree relating to the production and supply of iodized salt for human consumption. Currently, the rate of coverage for adequately iodized salt in Vietnam has risen to 82.5% and 31 of the 61 provinces in Vietnam have coverage rates above 90 percent **(fig. 3)**. The Vietnamese government has a policy for subsidising iodized salt for some 12 million ethnic minorities in mountainous areas of the country. There is a very well organised and efficient national IDD committee that oversees monitoring of the IDD elimination program. Provincial IDD committees undertake monitoring surveys three times a year and there is a national survey every second year. There is a central laboratory in the Hospital for Endocrinology in Hanoi that oversees all laboratories monitoring for urinary and salt iodine levels. IEC activities are well developed but are focused more on the elimination of endemic goitre rather than prevention of brain damage from iodine deficiency.

To ensure sustainability of the IDD elimination program it will be necessary for the government of Vietnam to strengthen the legislation to achieve USI and eliminate non-iodized salt from the marketplace. Vietnam expects to achieve the USI goal of over 90% coverage of the population and reduction of goitre rates to less than 10% by end of the year 2005.

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5.4

IDD Control in Indonesia

R. Djokomoeljanto, Satoto, Rachimi Untoro

5.4.1 Introduction

IDD has been known in Indonesia for many years. The oldest information about Goitre comes from Javanese copper inscriptions found at Bangli in Bali. A national survey in 1980-1982 of primary school children in 26 provinces described a >10% goitre prevalence in 68% of sub-districts and a >30% prevalence in 40% of sub-districts, reaching >80% in some villages. That same survey estimated that the country had 75,000 cretins (comprising 10-15% of the population in some areas), 3.5 million people with goitre, and 35 million living in endemic areas. By 1988 the total goitre prevalence (TGR) had decreased to 25%, and further to 19.9% in 1990.

The latest survey, in 1998, covered 27 provinces and found the distribution of the population among areas, according to goitre prevalence, was: non-endemic, 142.5 million; mild endemic, 36.8 million; moderate endemic, 8.2 million; and severe endemic, 8.8 million people. The TGR in schoolchildren had declined to 9.8%, better than the country's target of 18%, but the TGR of pregnant women in the same villagtes was 16.0%. The median UEI (urinary excretion of iodine) of pregnant women showed that 72% were ≥ 100 µg/L, and 13% were 50-99 µg/L. The median TSH in pregnant women was 4.0 µU/ml, and 30% were ≥ 5.0 µU/ml. Only 64% of households consumed adequately iodized salt (>30 ppm). The proportion of salt samples that met the requirement for fortification correlated well (r=0.8) with the median UEI of pregnant women.

It was estimated that the country lost 130,800,000 IQ points from iodine deficiency (Muhilal, 1998). Minimal brain dysfunction occurred even in formerly deficient areas that were now replete, despite normal UEI in schoolchildren and no increase in goitre prevalence (Bambang-Hartono 1996). Neonatal TSH values closely correlated with those of mothers (Yasin 1989). Furthermore, in iodine replete areas, some mothers with TSH of ≥ 5µU/ml give birth to children with abnormal neurological development noted at 0-2 years of age. Other serious problems were smaller birth weight, prematurity, and spontaneous abortion (Bambang Hartono 2001). The administration of iodized oil capsules improved infant survival (Cobra 1997).

5.4.2 Intervention programs

The intervention program in Indonesia followed the social process model put forward by Hetzel at the First Seminar on Endemic Goitre and Cretinism in Indonesia, held at Semarang in 1978. It was based on epidemiological studies showing IDD on virtually every island, and an appreciation of the damaging effects of iodine deficiency on the population, especially in the severely affected areas. In 1976 a goitre prevention component was adopted as part of Indonesia's community nutrition program. At a seminar in Semarang it was decided to classify endemic goitre by its prevalence as mild (10-19%), moderate (20-29%) and severe (>30%); this latter category also included the presence of endemic cretins in the population.

The country adopted the goal that no cretin would be born after the year 2000 (later changed to 2010). In 1990 a Ministry of Health decree established a National IDD Committee, which developed three strategies: (1) iodized salt for human consumption as the *permanent long-term strategy;* (2) iodinated oil injection or capsules for severely endemic areas, as a *short term measure;* and (3) iodized water as an appropriate technology in special high risk areas. (Benny Kodyat 1991)

5.4.2.1 Iodized salt

Salt Iodization began under Dutch rule in 1927, but stopped in 1945 when the salt monopoly was disbanded. A well established infrastructure is needed to provide and distribute good quality iodized salt throughout Indonesia, an archipelago with more than 13,000 islands. To simplify the problem, a *blanket approach* with 40 ppm KIO3 (± 25%) was adopted. A preliminary intervention trial in Central Java proved that this salt was effective in reducing goitre and increasing urinary iodine (Djokomoeljanto 1976, unpublished). The campaign against IDD started in 1976, with UNICEF support. Initially, responsibility and accountability for enforcement were not clear within the government, and no mechanism for coordination among involved ministries and the private sector existed.

In 1990, the Indonesian Government (GoI) resumed a nationwide IDD control programme with the assistance of the World Bank, UNICEF and other agencies. Its goal was to reduce the prevalence of IDD by monitoring the iodine status of the community and increasing the supply of iodized salt and its consumption, while improving interesectoral coordination.

The GoI started its Intensified IDD Control (IIDDC) Project in 1997, with support from the World Bank. Progress has been slower than expected because of unresolved problems with poor accountability and weak enforcement. National consumption of iodized salt at the household level increased from 78.2% in 1995 to 81.5% in 1999. However, the adequacy of iodized salt (i.e., containing > 30 ppm) rose only from 50% in 1996 to 65.5%,

Table 1. *Percentage of households using adequately iodized salt (>30ppm), by province and some districts.*

	WSm	Wjv	Cjv	Pati	Rbg	Ejv	Pb	NTB	NTT	SS	SES	Mlk	Mgl
1998	93.7	59.2	61.9	55.7	31.5	60.5	35.5	12.1	15.4	27.3	58.7	33.4	65.8
1999	90.3	54.3	55.7	49.1	31.9	63.6	28.4	12.5	23.0	36.6	52.9	34.9	57.8
2000	90.5	57.7	51.8	57.5	30.1	63.3	26.4	13.7	29.2	43.4	59.0	60.5	47.9
2001	86.1	62.7	55.7	53.9	22.9	63.2	35.8	18.8	32.4	54.7	60.7	--	73.8
2002	92.9	67.8	54.6	44.0	36.1	67.8	35.4	18.0	32.6	59.9	58.7	--	63.8

Source: *Technical Monitoring Mid Term Evaluation, Pati & Rbg, Pb are subdistricts with huge production of people's salt.*

Table 2. *Storage modes for household iodized salt and their iodine contents*

Method	Iodine content		
	Satisfactory (S)	Unsatisfactory (US)	Nil (0)
Closed	75.2%	12.5%	12.2%
Open	49.9%	23.5%	26.6%
Near oven/stove	59.6%	19.3%	21.2%
In the cupboard	81.7%	11.1%	7.2%
On the rack	70.1%	14.8%	15.1%

BPS 2002, 5=>30 ppm, US < 30 ppm

Table 3. *Number of iodinated oil injections (lipiodol) distributed and its coverage (Benny Kodyat, 1991)*

Plan (years)	Target	Total injections	% coverage
II (1974-1979)	1,036,828	1,036,828	100%
III (1979-1984)	6,484,262	5,928915	91.0%
IV (1984- 1989)	5,672,365	4,496,359	79.0%
Total	13,193,455	11,462,192	86.7%

Table 4. *Coverage of iodinated oil capsules (Yodiol®) in the year 2000.*

	Women of Child Bearing Age	Pregnant women	Nursing Mothers	Primary School Children
Target	7,177,519	870,273	914,470	678,661
Distributed	4,365,509	756,693	560,720	569,444
Coverage (%)	60.8%	86.9%	61.3%	83.9%

Source: Directorate of Nutrition, MoH, Nov, 2001

Table 5. *Urinary iodine concentrations from different sources in Central Java, 2003*

	<100µg/L	100-300µg/L	>300µg/L
Private outpatients (n=126)	11.9%	66.7%	21.4%
Private St Elisabeth Hospital (n=75)	2.7%	94.5%	21.0%

63.5%, 64.6%, 65.5% and 68.6% in 1998, 1999, 2000, 2001 and 2002, respectively.

According to the assessment of Susenas (*the National Health Survey*), only 4 of 27 provinces reached the target of >90% of households consuming iodized salt. Provinces in Java and Bali were still at the level of 40 – 70%, two provinces did not change. Based on comparisons within districts between 1998 and 2002, 57.5% of districts stayed at the same level, 14.6% were worse, and 19.6% improved their iodized salt consumption.

The salt industry relies on more than 25,000 small salt farmers to produce about 80% of the country's salt (called *people's salt*), with the remaining 20% provided by PT Garam, a government enterprise. The salt farmers are concentrated along the north coast of Java, and in Madura, Bali, South Sulawesi and East Nusa Tenggara. Java and Madura have the greatest capacity for salt production, and it is very low elsewhere. Small farmers use primitive traditional technology, producing low quality salt that is not suitable for Iodization. Their product is cheaper and has its own channel in the salt market, being sold to traders who then resell it to processors for Iodization and packaging. Monitoring of iodine levels in salt is the responsibility of the Ministry of Trade and Industry and the Institute for Drug and Food Control (Badan POM), depending on whether it is checked at production, retail or household level. Information sharing is needed but is not always smooth.

The report of the Mid-Term Evaluation of the IIDC Project (2000) showed that USI coverage for households is far from satisfactory **(Table 1)**. Two issues may arise. In Java, the districts with many producers of people's salt (Indramayu, Cirebon, Pati, Rembang, Probolingga) have a low consumption of iodized salt, perhaps due to infiltration of non-iodized salt and lack of public awareness. The other problems are logistic, in NTT, NTB and Maluku. For both issues law enforcement is the key to success.

Other observations from BPS showed that the concentration of iodine in salt is influenced by the storage method in homes **(Table 2)**.

5.4.2.2 Iodinated oil capsules

When severe and mild IDD were simultaneously found in the early stage of intervention, both the blanket approach with 40 ppm iodized salt *and* iodinated oil injection (*'lipiodol,'* containing 480 mg iodine per ml) were introduced. The latter was directed to remote areas and those with moderate to severe IDD, as judged by the TGR of school children and national survey results. Injection was given every 4 years: 0.2-0.4 ml lipiodol for children age 0-6 months, 0.3-0.6 ml for age 6-12 months, 0.5-1.0 ml for age 6mo-6 years, and 1-2 ml for age 6-45 years (Hetzel 1978).

Tables 3 summarizes targets and actual implementation of the injection program in 25 provinces from 1974-1989 (Five Year Development Plan II through IV). Overall, 11,462,192 of the 13,193,455 targeted injections (86.8%) were administered (Country Report, New Delhi 1989). Evaluation showed that this approach was not efficient as a national program, although effective for special circumstances. The GoI stopped it for several reasons, including failure to reach the same persons each 4 years, concerns about the risk of hepatitis from injections, the need to import the iodized oil, and high delivery costs.

PT Kimia Farma, with the help of Australia's CSIRO (endorsed by Dr. Hetzel), produces *yodiol* ® capsules (*'iodized-peanut-oil' Kimia Farma Indonesia*), which were then used in the national intervention program to overcome the above mentioned problems. This capsule was effective in preventing and treating IDD when given once a year. Subsequent field studies showed that iodized peanut oil was more efficacious in controlling iodine deficiency than was poppyseed oil containing the same amount of iodine (Untoro 1999). The capsule can be distributed through the channel already existing for vitamin A. Again, the criterion for receiving *yodiol* is the TGR of community schoolchildren and that of the rest of the population (r=0.93) (Tarwotjo 1982) which was also confirmed by the latest survey (Muhilal 1998). The 1995/96 – 1997/98 surveys revealed that the coverage of *yodiol* capsule distribution was good in pregnant women in areas with a high TGR, but not in those with a low TGR (Muhilal 1998). Each yodiol capsule contains 200 mg I/ml (±12 drops). The dose depends on the age and gender and is given once a year: infant (<1yr) 100 mg (6 drops), preschool children (1-5yrs) 1 capsule, and males 6-20 yrs 2 capsules. (Dept Health 1992)

In the year 2000 the iodinated capsule target was 7,177,519 for CBW (women of child bearing age), 870,273 for pregnant women, 914,640 for nursing women and 676,661 for primary school children. However, the actual coverage achieved only 60.8.4% target for CBW, 86.9% for pregnant women, 61.3% for nursing women, and 83.9% for schoolchildren (Directorate of Nutrition, 2001).

5.4.3 Monitoring and evaluation

The last survey determined goitre rate by palpation, which is known to have both inter-observer and even intra-observer variation. To investigate this, we applied the ThyroMobil model, initiated by Delange in

Europe, in 5 provinces in Indonesia. Our aim was to evaluate the present IDD status, using the internationally standardized methods of ultrasonography with estimates of size by palpation.

We found that IDD had been eliminated in large parts of Indonesia, but in many places it was replaced by iodine excess. In Java and Sumatra the median UEI was 195 µg/L. Only 17.2% of samples were below 100 µg/L, but 18.2% were above 300 µg/L, and 0.7% were even above 1000 µg/L! An extremely high value (>3000 µg/L) was only found in Central Java, in the district of Sukohardjo. We have not yet checked for *iodine-induced hyperthyroidism*. With the exception of Bali, results from the other studied provinces (West Sumatra, West Java, Central Java, Yogjakarta) were good (Djokomoeljanto 2001). These data supported those of the 1998 national survey indicating that IDD had been eliminated from most of Indonesia. Furthermore, the correlation between prevalence by palpation (9%) and ultrasonography (8.6% by age, 6.8% by body surface area) was very good (Djokomoeljanto 2001).

The program and its impact are now being evaluated, results to be ready early in 2004. Preliminary data from Central Java are encouraging as to iodine sufficiency, but many urine amples have excessive iodine (> 300 mg/L). The informal experience of one of us (RD) with urinary iodine determinations from private patients in Central Java, consulted for other thyroid diseases, suggested that their iodine status was good, but around 20% had elevated urinary iodine concentrations, raising the question of whether the amount of iodine in salt-40 ppm – should be lowered. Data of 2003 show schoolchildren from Sukohardjo still have very high UEIs (also noted in the ThyroMobil study) and their urinary iodine concentrations should be checked regularly.

5.4.4 Strength and weaknesses of the Indonesian IDD Control Program

Strengths – These include a political commitment to continue the IDD-CP, the existing updated regional goitre map, the Presidential Decree and Inter-Ministerial Decrees and Commitments on iodized salt regulation, and the good collaboration between the Dept. of Health and researchers in universities.

Weaknesses – Prominent among these are the geography of an archipelago like Indonesia, the diverse cultural pattern that dictates various preferences for types of food and salt, inadequate public awareness about IDD, the existence of much local salt of differing quality produced by poor farmers with their own socioeconomic problems, and the early stages of decentralization, which makes it difficult to develop and disseminate a standardized strategy for IDD elimination.

In order to have an Indonesian referral center for IDD and the IDD Control Program, the IDD Center (Pusat GAKY) was established in 2001 in Semarang, site of an internationally recognized IDD Laboratory. The mission of the Center is to develop expertise and support facilities in all IDD-related issues, to promote national IDD control in Indonesia, and to collaborate with all stakeholders in Indonesia and other countries towards IDD elimination. The Board of the Center consists of experts and interested scientists in IDD from the country's universities and research centers. A scientific journal on IDD and other information and communication systems are developed to advance the mission, and an IDD seminar is organized annually. The Center together with the IDD laboratory has a significant role in the latest final evaluation of the country's IIDDC Project (Intensified Iodine Deficiency Disorders Control Project).

5.4.5 Recommendations

The implementation of USI should have priority, especially in prominent salt producing provinces. Enforcement and control should be intensified to guarantee that only iodized salt is distributed in non-producing provinces, especially those that still have pockets of IDD. Imported or inter-island salt for consumption should be iodized at the focal point or earlier before distribution. The program and its impact on iodine nutrition must be monitored regularly. From our study, urinary iodine excretion is the most appropriate outcome indicator for efforts against iodine deficiency under field conditions at the district level (Pardede 1998), and the IDD Center with its IDD lab can support this program.

Appropriate iodized salt production technologyshould be available to the poor farmers or to groups (cooperatives) to enable them to produce better salt for iodization and to improve its selling price. The Ministry of Industry and Commerce has a heavy task to cope with these problems and attain the goal in 2010. Law enforcement must be endorsed, and social marketing should be strengthened.

Iodinated oil is still needed in the IDD control program to cover pregnant and nursing women, as well as women of childbearing age. In the meantime, people's awareness about IDD and the means for its correction should be enhanced through all available communication channels.

5.4.6 Salt Situation Analysis in Indonesia

In August, 2003, UNICEF sponsored a mission by a team, headed by Dr. Frits van der Haar, to review progress towards sustained IDD elimination in Indonesia through iodized salt. The report offers a detailed analysis of iodized salt and its utilization in the country.

Salt is produced in the country by evaporation of seawater, and this accounts for about one-third of the market, the other two-thirds coming from imports. Demand estimates in 2003 were household salt 700,000 MT (200,000 to be imported) and 55,000 MT in the food industry (35,000 MT from imports). East Java is the largest producing area (65%) followed by Central Java (14%), West Java, and South Sulawesi.

The country has about 20,000 small farmers, and 376 registered producers licensed to process iodized salt. Of these, about 80 produce adequately iodized salt. PT Garam is a state-owned entity that both produces and purchases people's salt. Non-iodized salt reaches consumers by direct sales from farmers or traders. Salt importation is relatively new, since 1998. The main sources are Australia and India. Efforts at improvement of quality have been only modestly successful. A considerable discrepancy in the market exists when non-iodized salt is available. Thus, the use of iodized salt is lower in the salt-producing provinces than elsewhere in the country. Monitoring of salt and enforcement of the regulations are not vigorous. Producers have little incentive to iodize salt. Indonesia produces its own iodine, under a monopoly by the state-owned company, Kamiah Farm.

The report offers detailed data from 2002 on iodized salt utilization, by province. In about one-third of the districts, household iodized salt consumption was less than 40%. The remaining 56% of districts had household iodine consumption in the 40-89% range. The lowest consumption of iodized salt was in salt-producing regions.

The mission commented on advocacy and communication. A division of responsibility within the central government has limited enforcement of regulations for salt iodization. With decentralization, recent efforts have been directed at district legislation. Nationally, knowledge about the importance of iodized salt is about 72%. Communication measures have included TV and radio spots, public service announcements, pamphlets, brochures, and health promotion material from the Ministry of Health. Various women's groups have been recruited for advocacy.

The national legislation requires that household salt must be iodized and contain 30 ppm iodine, but the wording in the various decrees makes it possible to sell non-iodized salt directly to consumers. Several districts have passed laws that forbid this.

The mission made a number of recommendations, mostly for the Ministry of Industry and Trade, which is responsible for salt. These included: (1) addressing the problem of non-iodized salt reaching households; (2) assuring that iodized salt is actually being used throughout the food processing industry; (3) supporting district legislation prohibiting the sale of non-iodized salt; (4) advocacy; (5) permanent funding for annual monitoring of household iodized salt use in districts; (6) strengthening the message in health education by emphasizing protection of the developing brain;(7) involving religious leaders in delivering the IDD message; (8) assessing salt flow at the district level, and developing strategies to see that it is iodized; (9) encouraging community monitoring of iodized salt; (10) using partners for advocacy; and (11) offering assistance at the district level in developing annual plans for IDD elimination.

5.4.7 Further Comments

Several coordinating committees exist. One is chaired by the Director General of the Ministry of Community Health, and the Head of Nutrition is its Secretary; a main task for it has been handling the large World Bank-funded project for salt iodization, which ends in 2004. A fortification coalition also exists, to consider applying for GAIN funding, but iodine is not a prominent focus for it.

A meeting in December 2003, chaired by Dr. Rachmi Untoro, Director of Nutrition in the Ministry of Community Health, included about 20 participants, from various branches of the government, salt producers, the IDD Center, UNICEF, Kamiah Farm, and the IDD control program. The group noted that the results of the 2003 survey with urinary iodine determinations will be available shortly; initial data show that the urinary iodine levels in most places are in the iodine-sufficient range, and some trend towards excess. There was much discussion about small producers who sell non-iodized salt of low quality locally at prices considerably less than that for the iodized product.

The law requires 30-80 ppm and applies to animals as well as humans, but it is not strongly enforced. As elsewhere, most of the price difference comes from a simultaneous upgrading of salt quality, and efforts to iodize the community without upgrading salt quality were suggested. There was general agreement that because of decentralization, most efforts must be through local governments and should emphasize education, support from local leaders, acceptable prices for iodized salt, and then enforcement. Currently, about 73% of households use adequately iodized salt (at least 30 ppm), and another 12% have some iodine, but <30 ppm; thus 85% are receiving some iodized salt. The urinary iodine data suggest that some iodine may be consumed from other sources, but these have not been identified.

Dr. Djokomoeljanto described several initiatives towards coalitions. One is a working group of colleagues from different universities who are interested in IDD. These are being consulted along with public health officials in their communities to develop approaches to local coalitions. In his area of Semarang, he has formed a coalition for central java, which includes endocrinologists, the IDD Center, nutritionists, public health workers, the Department of Industry, experts in salt engineering, salt producers, representatives of local governments, NGO's and the media. This group meets every month at different sites to promote activities aimed at IDD elimination, investigation, and universal salt iodization. He has also developed a national network of academics concerned with IDD, and is responsible for IDD in the Indonesian Endocrine Society.

5.4.8 Conclusion

Indonesia has made great progress against IDD with salt iodization. The key problem is the availability of non-iodized salt in many areas, especially those that produce salt. With decentralization, much of the effort is now shifting to district level, to develop locally appropriate laws prohibiting the use of non-iodized salt. Meanwhile, several coalitions of groups involved at various levels with IDD elimination are being established. Much has been accomplished in the past two decades, but much more remains to be done.

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6

Middle Eastern and North African Region

F Azizi

6.1 Summary and Lessons Learnt

Summary of IDD characteristics (prevalence, areas of endemicity, control measures, iodized salt production and consumption and urinary iodine levels, total raw and iodized salt production) in countries of the Middle East and Eastern Mediterranean Region are described.

In general this region could be considered as one of the problem regions of the world, with many areas of moderate to severe iodine deficiency. The efforts of international organizations such as WHO, UNICEF and ICCIDD have helped the countries of ME & EMR Region to evaluate IDD in almost all countries, implement control programs including salt iodization in many and sustainable control of IDD elimination program in some countries.

The I.R. Iran conducts an optimal program for control of IDD. A sustainable and well-managed iodization program is functioning in the I.R. Iran with the following programmatic indicators:

a) From 1989, an effective and functional national body, the IDD National Committee, responsible to the government for the elimination of IDD has been active. This council is multidisciplinary involving the relevant fields of nutrition, medicine, industry, education etc.
b) Political commitment to universal salt iodization and the elimination of IDD has been formed in 1989 and is ongoing.
c) A responsible executive officer has been appointed for the IDD elimination program since 1990.
d) Legislation on universal salt iodization has been applied since 1992. Ministry of Industry announced that salt factories should produce only iodized salt for household use.
e) The country has been committed to assessment and re-assessment of progress in the elimination of IDD, with unlimited accesses to laboratories able to provide data on salt and urinary iodine.
f) A program of public education and social mobilization on the importance of IDD and the consumption of iodized salt have been vigorously followed in the last 11 years. The program has been integrated into the health network, with full participation of Behvarzes (rural health workers) in education and monitoring.
g) Regular data on salt iodine at factory (daily), retail (monthly) and household levels (yearly), are collected in each province and analyzed by the National Committee.

h) Regular laboratory data on urinary iodine in school-aged children with appropriate sampling for higher risk areas is in process in each province on yearly basis and nationally every 5 years.
i) Excellent co-operation from the salt industry in maintenance of quality control, supervised by the IDD executive officer.
j) Database with recording of results and regular monitoring procedures, particularly for salt iodine and urinary iodine, now available in the Ministry of Health. Neonatal TSH has been measured in Tehran in 1989 and 1997-1999. This shows significant decrease in transient hyperthyrotropinemia and recall rate.

The I.R. Iran therefore fulfills all 10 programmatic indicators set by (WHO/UNICEF/ICCIDD 2001; Azizi 2002). According to these criteria, I.R. Iran appears to have reached sustainable IDD control program since 1996, an achievement that has been recognized by WHO-EMRO in the year 2000. Monitoring of IDD control program is planned every 5 years to evaluate the sustainability of the program. It is concluded that implementation of an adequate and sustainable program of IDD control requires many effective programmatic steps, in particular its integration in the health network and mandatory iodized salt consumption.

6.2 Background and History

High prevalence of endemic goitre and findings of severe iodine deficiency in Chitral and Gilgit regions of Pakistan was reported in the Lancet in the early years of the 20th Century (McCarrison 1908). Regardless of the high rates in many regions of many other countries in EMR (e.g., Mosul province in Iraq, Shahriar in the I.R. Iran, and in most regions of Lebanon), goitre was regarded as being strictly restricted to certain geographical areas and, thus, not considered as public health problem of national importance (Baghchi, Rejeb 1987). Therefore, surveys in EMR countries had been limited to one or two endemic areas. The Islamic Republic of Iran began to study the prevalence of goitre and other iodine deficiency disorders in 1983 and conducted a national IDD survey in 1989, which revealed hyperendemic and endemic goitre in all provinces of Iran (Azizi et al 1990). A major landmark in IDD control in the EMR was the review of the prevalence and control measures of iodine deficiency disorders in EMR Member States in 1987 (Baghchi, Rejeb 1987). For the first time, it brought to the Member States' attention, the fact that in a number of countries of this region, IDD was a major public health problem meriting serious consideration and urgent action. **Table 1** summarizes major activities related to IDD in the Region in the last 13 years.

In order to respond to the growing interest of member states, EMRO convened an inter-country consultation of experts in December 1987 to collect more information, exchange experiences and develop guidelines that would assist countries to define the problem and mount national control programs. These guidelines were published (in Arabic and English) in 1988 as EMRO Technical Publication No12, entitled "Guidelines for a National program for the control of Iodine Deficiency Disorders in theEMR"

Table 1. *Major IDD Activities in the ME & EMR since 1987*

Year	Activity
1987	Review of IDD in EMR Member States
1987	Inter-country consultation
1989	IDD survey in I.R. Iran and IDD control program
1990	Inter-country workshop in Tehran, I.R. Iran
1990	IDD discussion- 37th session of WHO-EMRO
1992	Training workshop for laboratory staff, Damascus, Syria
1994	MENA, regional IDD workshop, Tehran, I.R. Iran
1995	The first regional meeting of salt producers in Jordan
1996	Iodine sufficiency in I.R. Iran
1999	Symposium-workshop on assessment & monitoring, Tehran I.R.Iran
2000	Regional meeting for promotion of iodized salt, Dubai, UAE
2000	IDD free countries: I.R. Iran, Tunisia. Salt iodization started in 17 countries, USI achieved in 6 countries
2001& 2002	First and second IDD Regional Training Course: Monitoring and evaluation of IDD elimination program, Tehran, I.R. Iran

In 1990, an inter-country workshop on IDD was held in Tehran, I.R. Iran, to exchange experiences and to develop approaches. Subsequently, a technical paper was presented to the thirty-seventh session of the WHO Regional Committee for the Eastern Mediterranean, alerting the ministers of health of all countries of the region to the devastating effect of IDD on brain development and cognitive function. Since then WHO, often jointly with UNICEF and ICCIDD, has made great efforts to support countries in their efforts to deal with this very important deficiency, holding a number of important workshops and training courses. A tri-regional traveling seminar organized in collaboration with the WHO-EMRO, South East Asia and Western Pacific region in India and Nepal in 1991 to observe salt iodization and iodize oil in practice; the first meeting on universal salt iodization for salt producers in the Region was held in Jordan in 1995 and a number of technical consultancies were conducted. Of these, the MENA regional IDD workshop was held in December 1994 in Tehran, I.R. Iran by UNICEF and a symposium workshop on assessment and monitoring of IDD in countries of EMR was held by WHO, September 1999 in Tehran.

In 1988, the I.R. Iran carried out the first national IDD survey in the Region, which revealed a high prevalence of IDD (Azizi et al 1990). According to the latest report of EMRO in 1999, Egypt, Jordan, Lebanon, Morocco, Oman and the Syrian Arab Republic also carried out surveys. The Islamic Republic of Iran and the Syrian Arab Republic were the first countries in the region to start iodizing salt. The first regional meeting of salt producers in the Eastern Mediterranean Region, held in 1995, led to the establishment of a regional association of iodized salt producers.

6.2.1 Present State

By late 1998, 13 countries and in 2000, 16 countries had initiated salt-iodization and 6 countries had reached the goal of universal salt iodization (USI) by demonstrating that at least 90% of households consume adequately iodized salt **(fig.1)**

I.R. Iran had been declared as an “IDD free” country by showing that more than 95% of households consumed adequately iodized salt and the median urinary iodine is above 100µg/L in each of the 26 provinces (Regional Meeting, Dubai 2000). More recently, Tunisia has also achieved satisfactory iodine status and both countries have been accorded IDD-free status by WHO-EMRO in the year 2000 (Regional Meeting Dubai 2000). In 2001 the Endocrine Research Center and the Ministry of Health

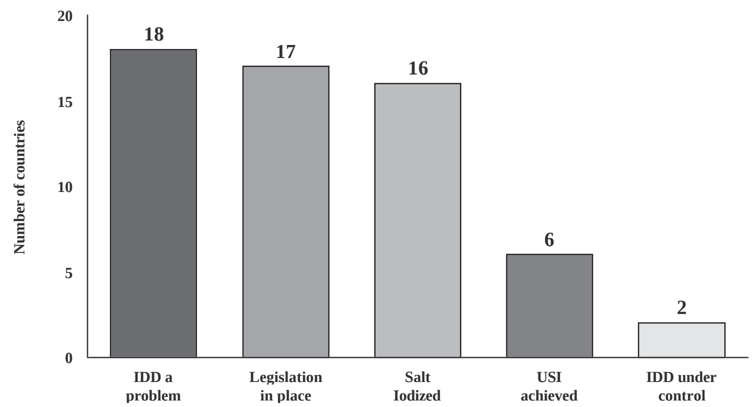


Fig.1 *Progress in IDD control in countries of the region in the year 2000 (adapted from WHO-EMRO)*

of I.R. Iran were appointed by WHO/EMRO to hold an annual training course on monitoring and evaluation of IDD elimination programs; the two initial courses were offered in 2001 and 2002 with participation of 12 countries (2001) and 21 countries (2002) of the region together with countries of Central Asia and Eastern Europe, respectively.

In the year 2001, the status of IDD in the ME & EMR countries was:

Mild IDD: Bahrain, Egypt, Kuwait; Libya, Oman, Palestine, Qatar, and UAE:

Moderate IDD: Morocco, Saudi Arabia, Sudan, and Yemen;

Severe IDD: Afghanistan, Iraq, Pakistan; and

Table 2. *The status of IDD in the Middle East and Eastern Mediterranean Region, 2001*

Name of Countries	Status
I.R. Iran, Tunisia	IDD eliminated
Jordan, Syria, Lebanon, Yemen	IDD almost controlled
Sudan, Pakistan, Egypt, Libya, Oman,	USI begun, data is needed
Morocco, Iraq	-
Bahrain, Kuwait, UAE, Qatar, Palestine	Mild IDD or data unavailable
Afghanistan	Severe IDD, difficult to study

IDD under control: I.R. Iran and Tunisia.

Most recent information on the status of control of IDD in the countries of this region is summarized in **Table 2**.

6.3 Islamic Republic of Iran

The first documented report of goitre in 1968 reported goitre prevalence of 10 to 60% in Iran. However, no comprehensive studies were carried out to examine the extent of iodine deficiency disorders, nor was any long-term preventive measure taken. In 1983-84, after a gap of 15 years, Azizi et al reported hyperendemia of goitre in Shahriar, Tehran, south-central province of Kohkyloyeh-BoyerAhmad and many villages located in north of Tehran City (Azizi et al 1993, 1995) with low urinary iodine excretion in many subjects. Schoolchildren of these villages had, both physical and mental growth retardation, low T4, high TSH, abnormal neurological findings, psychomotor disturbance and hearing deficits (Azizi et al 1995).

These findings prompted the Ministry of Health and Medical Education to form an Iranian National Committee for Control of IDD (INCCI) in 1988. A nation-wide survey, performed under the supervision of INCCI,

Table 3. *Urinary iodine concentration in selected endemic and hyperendemic regions before iodized salt distribution*

Location	Province	Urinary iodine (µg/L)
Kiga	Tehran (rural)	20±11
Randan	Tehran (rural)	12±5
Zagoon	Tehran (rural)	18±10
Keshar	Tehran (rural)	19±10
Tehran City	Tehran (urban)	39±19
Shahriar	Tehran (urban & rural)	71±39
Hanna	Esfahan (rural)	40±21
Yasuj	Boyer-Ahmad (urban)	34±39
Doruhan	Boyer-Ahmad (urban)	24±17

showed goitre as being endemic in all and hyperendemic in the capital cities of 5 provinces (Azizi et al 1990). Mean urinary iodine excretion was below 100µg/L in all and <20µg/L in many localities examined **(Table 3)** (Azizi et al 1990, 1993, 1995).

The INCCI prepared a national plan, which detailed objectives and strategies for IDD control. Salt iodization began in 1990. Although the production, distribution and consumption of iodized salt increased gradually, a nation-wide survey in 1993 showed that less than 50% of the households were using iodized salt. INCCI announced universal salt iodization (USI) and all salt factories were obliged by law to produce only iodized salt for household use. National surveys in 1994, 1996 and 1998 have shown that more than 95% of the households were consuming iodized salt.

In 1996, the second national survey was conducted 7 years after the initiation of iodized salt production and 2 years after the implementation of the new law for mandatory consumption of iodized salt by households (Azizi et al 1995). The total number of surveyed schoolchildren was 36178 of which 2917 had urinary iodine determination. In 16 of 26 provinces, total goitre rate was more than 40% in boys and over 50% in girls. However, the majority of schoolchildren had small goitres of grade 1 **(fig.2)**. There was no significant difference in goitre prevalence between boys and girls or schoolchildren of rural and urban regions.

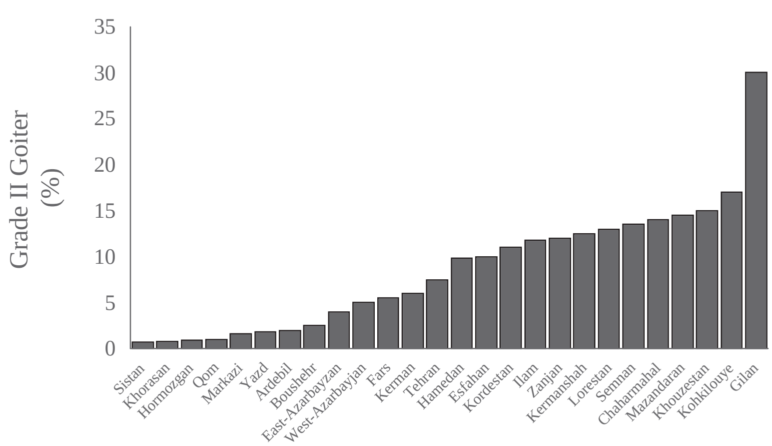


Fig.2 *Schoolchildren with visible goitre in 26 provinces (I.R. Iran, 1996)*

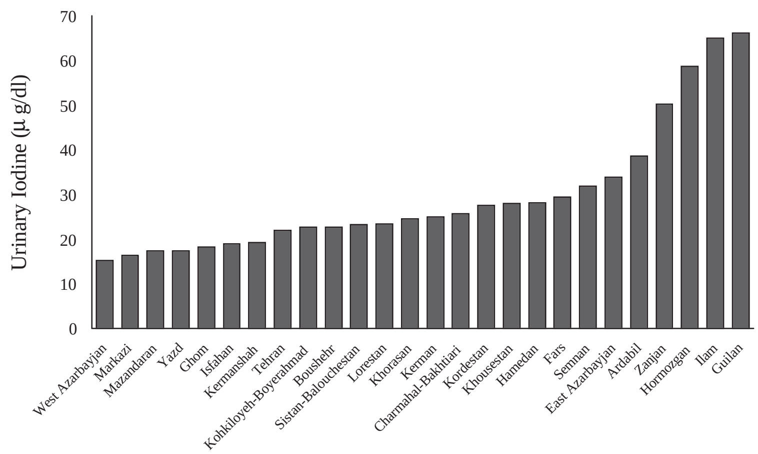


Fig. 3 *Median urinary iodine concentration in schoolchildren of 26 provinces, I.R. Iran, 1996*

In all 2917 schoolchildren, the median urinary iodine excretion was 20.5µg/dl. Two thirds of schoolchildren had urinary iodine between 10 to 30µg/dl. 85.1% of children had urinary iodine equal to or in excess of 10µg/dl. 9%, 2.3% and 3.6% had mild, moderate and severe iodine deficiency, respectively. **Fig. 3** shows median urinary iodine excretion in schoolchildren of 26 provinces. The highest and lowest values are from Guilan (North) and West-Azarbayjan (Northwest) provinces, 65 and 13µg/dl, respectively. There was no correlation between the prevalence or severity of goitre and urinary iodine excretion.

It is evident that the prevalence of goitre was still high in many provinces in 1996. Since the study was performed when the majority of people had used iodized salt only for 2 years, it was too early to expect that the consumption of iodide should result in reduction of goitre prevalence; since the majority of 8 to 10 year old children had, at the time, passed most of their life without adequate iodine supplementation.

It has been shown that thyroid size in children exposed to iodine deficiency in the first years of life might fail to regress completely following consumption of iodized salt, and children born prior to iodine prophylaxis, 10 years after intervention, still have larger thyroid volume than children from iodine sufficient area.

The most sensitive method for the monitoring and evaluation of an IDD control program is the determination of urinary iodine excretion.

Findings of 1996 national survey showed that the median urinary iodine excretion in schoolchildren in Iran (20.5µg/dl) was at the top of the optimal range, i.e. 10 to 20µg/dl, recommended by WHO/UNICEF/ICCIDD (2001). In 20 of 26 provinces the median urinary iodine was between 13 to 30µg/dl and in 6 provinces, it was in a range that might be considered to be accompanied by the increased risk of iodine-induced hyperthyroidism (WHO/UNICEF/ICCIDD 2001; Azizi 2002). The reason for the increase in urinary iodine has been studied in the Guilan province and it was attributed to an increase in consumption of salted food in the dietary habits of the population of this province (Rahmani et al 2001). Guilan and 5 other provinces have been among hyperendemic regions, where in 1993 and 1994, iodine supplementation in the form of iodized oil injection had been offered. A repeat survey in one of these provinces, Ilam, has shown a decrease in mean urinary iodine to 20.5µg/dL. The latest National IDD survey performed in 2001-2002 revealed total goitre rate of 13.9% and median urinary iodine of 16.5µg/dL. 5.8% of the schoolchildren had urinary iodine excretion below 5µg/dL.

The I.R. Iran conducts an optimal program for control of IDD. A sustainable and well-managed iodization program is functioning in the I.R. Iran with the following programmatic indicators:

a) From 1989, an effective and functional national body, the IDD National Committee, responsible to the government for the elimination of IDD has been active. This council is multidisciplinary involving the relevant fields of nutrition, medicine, industry, education etc.
b) Political commitment to universal salt iodization and the elimination of IDD has been formed in 1989 and is ongoing.
c) A responsible executive officer has been appointed for the IDD elimination program since 1990.
d) Legislation on universal salt iodization has been applied since 1992. Ministry of Industry announced that salt factories should produce only iodized salt for household use.
e) The country has been committed to assessment and re-assessment of progress in the elimination of IDD, with unlimited accesses to laboratories able to provide data on salt and urinary iodine.
f) A program of public education and social mobilization on the importance of IDD and the consumption of iodized salt have been vigorously followed in the last 11 years. The program has been integrated into the health network, with full participation of Behvarzes (rural health workers) in education and monitoring.

g) Regular data on salt iodine at factory (daily), retail (monthly) and household levels (yearly), are collected in each province and analyzed by the National Committee.
h) Regular laboratory data on urinary iodine in school-aged children with appropriate sampling for higher risk areas is in process in each province on yearly basis and nationally every 5 years.
i) Excellent co-operation from the salt industry in maintenance of quality control, supervised by the IDD executive officer.
j) Database with recording of results and regular monitoring procedures, particularly for salt iodine and urinary iodine, now available in the Ministry of Health. Neonatal TSH has been measured in Tehran in 1989 and 1997-1999. This shows significant decrease in transient hyperthyrotropinemia and recall rate.

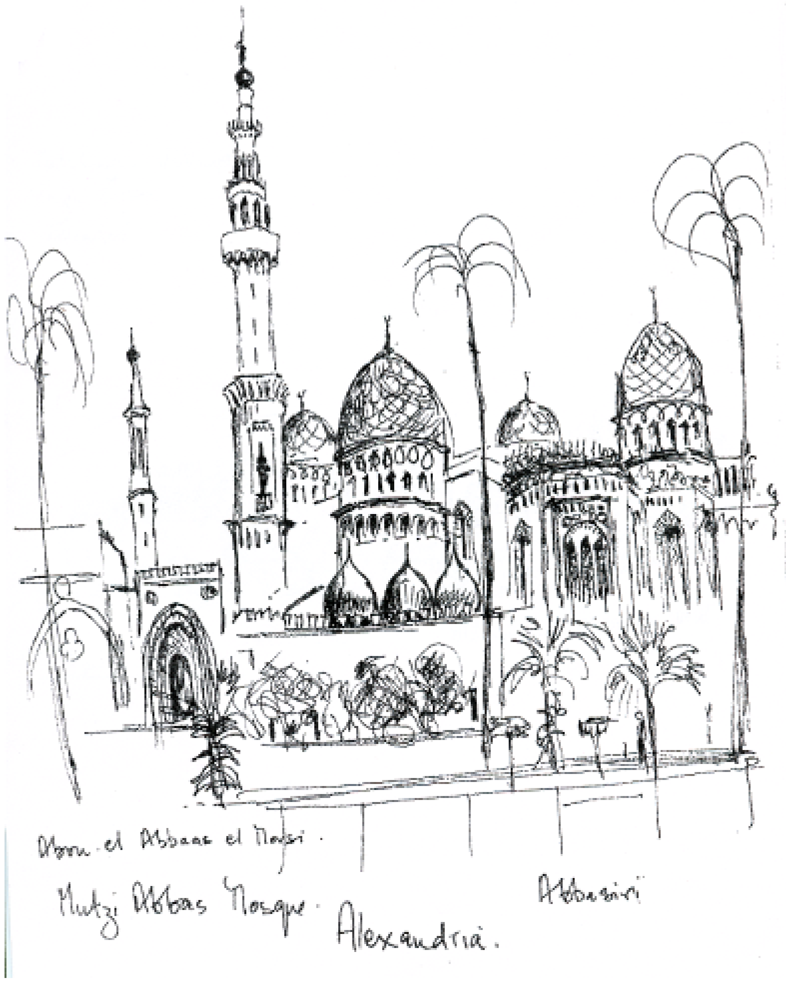
The I.R. Iran therefore fulfills all 10 programmatic indicators set by (WHO/UNICEF/ICCIDD 2001; Azizi 2002). According to these criteria, I.R. Iran appears to have reached sustainable IDD control program since 1996, an achievement that has been recognized by WHO-EMRO in the year 2000. Monitoring of IDD control program is planned every 5 years to evaluate the sustainability of the program. It is concluded that implementation of an adequate and sustainable program of IDD control requires many effective programmatic steps, in particular its integration in the health network and mandatory iodized salt consumption.

6.4 Other Countries

In **Tunisia (**Kharabsheh et al 2000) national survey in 1995 revealed TGR of 0. 58%and median UI<50µg/L in 8% of school children aged 8-10 years. A throughout IDD control program was implemented in 1996. The country was announced to be "IDD free" by WHO/EMRO in the year 2000. East south region had low iodized salt consumption (77.9%).

In **Jordan** (Kharabsheh et al 2000) national survey in1993 was indicative of moderate to severe IDD (TGR=37.7%, MUI= 4.0µg/dL). Jordan has been successful in implementation of a baseline assessment of IDD in 1993, has adopted an IDD Control Program since 1995 and completed a monitoring and evaluation program since 2000. National survey in 2001 showed a significant increased in MUI in all governorates (MUI=15.4µg/dL, TGR=32.1%).

Yemen (Azizi 2001; Zein et al 2000) had been known as a country with severe IDD problem. The National IDD Control Program was been launched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Alexandria.

in 1995. National survey in 1999 revealed TGR of 16.8% and MUI of 17.3µg/dl. Severe, moderate and mild IDD was found in 7.3%, 8.7% and 18.5% respectively. Household consumption of iodized salt increased from 22% in 1995 to 54% in 1999 and now reaches to 60%. Since the introduction of universal salt iodization in 1996 both the prevalence and severity of IDD were reduced markedly and Yemen can now be classified as a country with a mild IDD problem. However, the low level of households consuming iodized salt may hamper the goal of IDD elimination.

In **Syria** (Mohan 1999) salt iodization program has been launched since 1994. IDD is almost under control. A survey in 2001 revealed an increment in MUI. The results are not available. Household consumption of iodized salt increased from 24% in 1995 to 90% at the present.

In **Lebanon** (Matovinovic 1961) salt iodization started in 1992 and was implemented in a uniform manner by 1995. In 1994 National Committee for IDD Control was formed.

In **Egypt** (Cable Y 1968) salt iodization program began in 1993 and the government has successfully upgraded salt production plants to meet country's iodized salt needs. Major activities for national IDD control program have started in 2001 in 5 governorates and continue to cover all governorates within 2 years.

In **Morocco** USI was officially endorsed in 1995. National survey in 1993 revealed MUI<5µg/dL and <10µg/dL in 20% and 63% of the population, respectively. The next step is the launching of national strategy to increase iodized salt consumption and implementation of monitoring system.

Iraq (Caughey, Follis 1965) has begun salt iodization since 1990. National IDD committee was formed in 1993. High prevalence of goitre was reported in Northern and Western provinces. Household consumption of iodized salt increased from 51% in 1997 to 90% in 2000.

In **United Arab Emirates** (Demarchi 1969). The national committee was established in 2000. Salt iodization is planned for 2001. National screening program for neonatal hypothyroidism have been implemented since 1998.

In **Afghanistan** the next five-year plan is due to be implemented in three stages (assessment, salt iodization and monitoring) from 2002-2006.

National survey in 1995 in **Saudi Arabia** (Al-Nuaim et al 1997) revealed the presence of mild IDD (Lowest MUI (11µg/dL): Southern province, highest goitre rate: Asir region). There is need to launch an IDD control program especially in the southern province.

Table 4. *Summary of IDD Status*

Countries	**Endemic region of the country**	**Prevalence (before intervention)**
Afghanistan	Northeast and Southwest regions	High prevalence in these regions about 80% 30% in Nanghadr Province
Egypt	Oases in southwest Egypt	26% in these areas
I.R. Iran	Highly endemic in southwest of Tehran (Shaahriar)	17-100% among schoolchildren in various regions
Iraq	Northern mountain region bodering Turkey (Mosul), Areas around Baghdad	60-85% in hyperendemic northern area, about 30% around Baghdad
Jordan	Northern region	37.7 (18-76%)
Lebanon	Throughout	40-75% in mountain and hilly region and about 12% in coastal areas
Libya	Endemicity in Fezzan province	20-55% in most areas of Fezzan
Morocco	Azilal region, Atlas mountains	65% Azilal; 29% Atlas Mountains; TGR 22%
Oman	Only mild	TGR 10%
Pakistan	Alarming prevalence in Gilgit and Chitral, high level in Multan	80-90% in Gilgit and Chitral, high endemicity in Multan
Palestine	Not available	14.9% in schoolchildren
Saudi Arabia	Southern province	30% in Asir region
Sudan	Dafur in western Sudan, patches in other areas	40-65%
Syria	Mountainous region	TGR 70%
Tunisia	Northwest mountainous regions	14-51%
Yemen	Highlands regions	60-100%; TGR 32% in northern part
UAE	Desert and mountainous areas	1.5-20%

Base line surveys showed that no part of **Sudan** (Baghchi, Rejeb 1987; Benmiloud 1987; Eltom, Abdul Rahman 1984) is exempted from the IDD problem. A technical committee was formed in 1991. USI was implemented in 1997.

National survey in 1997 revealed severe IDD in Western Zone and moderate IDD in Upper Nile and Kordofan. In the year 2000, 2.5-12.5% of households used iodized salt, 5-12.5% used both iodized and non-iodized salt and the majority (80-95%) used non- iodized salt.

56 million people (40%) in **Pakistan** (Baghchi, Rejeb 1987; Mahmund, Siraj-UL-Haq 1986) are at risk of IDD and 72% of 8-11 year old children have mild to moderate iodine deficiency. Legislation on USI and national IDD control programs doesn't exist.

Fig. 4 *Comparison of IDD status in countries of ME & EMR in 1993 and 2000*

Libya (Azzizi 1993) had enacted legislation and implemented universal salt iodization in 1980.

National survey is being planned to evaluate impact of salt iodization.

In **Oman** there is mild IDD according to national survey in 1993. Legislation on salt iodization was passed in 1995. Household consumption of iodized salt increased from 35% in 1996 to 68.5% in 2000. There is no national IDD control program.

In **Palestine** the national committee has been established recently. Committee strategy focused on adoption of salt iodization along with the intensive nutrition education.

Comparison of IDD status in countries of the region in 1993 and 2000 is shown in **(fig.4)**.

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7

The Elimination of IDD in the Americas

Eduardo A Pretell

7.1

Summary and Lessons Learnt from the Region

Many experiences in the American Region underscore the importance and deleterious effects of iodine deficiency on human development and the urgent need for its elimination through an effective comprehensive strategy. Some of these 'lessons learned' are listed below:

1. Although iodized salt was recognised as a means to correct iodine deficiency, and salt iodization was implemented in most countries in the 1960s and 1970s, the actual impact was poor, so more than 30 years were lost in the battle against IDD. The main reasons for this delay were dim comprehension of the problem and its magnitude, inadequate governmental support, absent educational efforts, and failure to involve all sectors in addressing the problem.

2. This negative experience emphasises sustainability as a very important goal in national control programs, and it should be considered from the outset in developing a strategy.

3. Pioneering studies in the Region during pregnancy pointed to lack of iodine as a major cause of irreversible brain damage in the fetus, and this, rather than goitre, emerged as the gravest consequence of iodine deficiency. Concern about this finding, confirmed by others around the world, led the World Summit for Children to declare the elimination of IDD as a priority goal to be met by the year 2000.

4. Research studies on iodized oil for correcting and preventing iodine deficiency paved the way for rapid control of the problem in Peru and its widespread use around the world, while awaiting the more slowly paced implementation of USI.

5. The regular measurement of iodine in salt and urine and surveys of iodized salt consumption have been validated in the Region as appropriate indicators for the diagnosis and monitoring of iodine nutrition in populations.

6. Wide ranges in the amount of iodine added to salt, both mandated and actually found, carry the risks of insufficient or excess iodine supply, and should be adjusted to more constant and appropriate levels.

7.2

Introduction

7.2

Introduction

The American countries have a rich history of iodine deficiency. Statues in the Andes and Mexico show that endemic goitre existed long before Columbus arrived. The severity of iodine deficiency followed geologic patterns similar to those elsewhere in the world. The worst endemias were in isolated mountain communities. The Andean Regions and Central Mexico were the most afflicted, but many other parts of the hemisphere were also severely involved, and virtually no country in mainland Latin America was free of iodine deficiency. (Kelly and Snedden 1960, Dunn, Pretell et al 1986; Pretell and Dunn 1987).

Modern surveys for goitre within individual counties began in the 1930s. Almost all had at least some regions where the goitre prevalence was more than 50%, and several counties, such as Bolivia, Brazil, Ecuador, Peru, Mexico and Guatemala, had iodine deficiency in most of their territory. During the 1950s and 1960s virtually every country passed a law mandating iodized salt and establishing arbitrarily a wide range of iodization levels. Some programs of prophylaxis with iodized salt were transiently successful, but most were not (Schaefer 1974, Noguera and Gueri1994). Those that were successful initially later relapsed e.g., Guatemala, Colombia and Mexico, mainly because several common problems emerged. First, laws were not enforced and did not fix responsibility for absorbing the cost of salt iodization. No Latin America country addressed these issues satisfactorily. Secondly, monitoring was either absent or inadequate. Thus, after initial enthusiasm from the government and producers for regular checks on iodine levels in salt, interest waned, monitoring lapsed, and the iodine content salt either disappeared or greatly diminished. Thirdly, the importance of iodine deficiency and its correction was not adequately communicated to the relevant sectors, such as different branches of the government, the health establishment, industry, and most importantly, consumers.

By the 1980s and 1990s, after laws mandating iodized salt had existed for 30 years, only a few countries were nearing iodine sufficiency, and the overall goitre prevalence had not significantly changed (Pretell and Dunn 2002). In 1999, despite significant progress compared to other regions in the world, iodine deficiency as a public health problem was still present in

19 countries (WHO, 1999). This general failure in Latin America provides a valuable lesson of what can happen, as efforts for iodine prophylaxis are renewed in this region or initiated in countries elsewhere in the world.

The present article summarizes some recent information collected principally by the ICCIDD Regional Coordinator and the Subregional Coordinator for Central America and the Caribbean, from their reports, consultancies in individual countries (IDD Newsletter, 2001), and experience with the ICCIDD/Merck ThyroMobil project, which visited 13 countries in the region in 1998-2000 (Pretell et al 2000). The information on Peru reflects the author's experience as investigator at the Cayetano Heredia University and as Director of the National IDD Program and Minister of Health.

7.2.1 Implementation of IDD Control Programs

i) Background

A renewed interest in IDD arose in the late 1970s and early 1980s, and gained strength during the 1990s. The approach to its control has varied widely among different countries in the region, reflecting the diversity of their cultural, political, and geographical situations. This effort has had two different periods, one during the early 1980s, when only 3 countries approached the problem, and a later one during the 1990s that involved the majority of countries, as described below.

In the period 1983 to 1985, three Andean countries, Bolivia, Ecuador and Peru, were the first to reassess their iodine nutrition and to implement effective IDD control programs. They share the rugged mountainous terrain of the Andes and the Amazon jungle as dominant features of their geography. In the early 1980s, their goitre prevalences were 71% for Bolivia, 80% for Ecuador and 36% for Peru. All three have scattered inland salt deposits, in addition to sea salt in Ecuador and Peru.

With strong external economic support, Bolivia and Ecuador began implementing IDD control programs in 1983, mainly by monitoring the production and consumption of iodized salt. This process required adjustment to the unique features of each country. In Bolivia little iodized salt was available to the poor part of the population, so the government developed a semi-autonomous corporation that built salt iodization plants for co-operatives of small producers located throughout the country; this approach involved enormous logistic difficulties for introducing iodization into salt production and distribution. In contrast, most of Ecuador's salt comes from the sea and its producers are located in a small coastal area. About half the country's population lives along the coast, and is iodine sufficient; the remainder resides in the mountains and jungles, where iodine deficiency is severe. Peru began implementing its program in 1985, relying mainly on governmental support, and also instituted monitoring with urinary iodine. The Peru program has been recognized as a successful model for the sustained elimination of IDD and is described in more detail later in this chapter. The three countries simultaneously devoted major efforts to education, communication and information at all levels - government, salt producers and the general population in the affected areas.

These control programs have been evaluated by international teams of experts and the three countries declared virtually free of iodine deficiency as a public health problem, Bolivia in 1996, Peru in 1996 and 1998 Ecuador in 1999. However, the evolution and outcome of these control programs have been different. Ecuador and Peru have succeeded in sustaining the elimination of IDD, while Bolivia, after achieving iodine sufficiency, is now deficient again, because of lack of governmental support, a weak salt industry, and a decline in communication and monitoring activities, among other factors.

During the last 15 years almost all other Latin American countries have reassessed their iodine status and implemented programs for the control of IDD. The commitment undertaken by governments at the World Summit for Children and the support offered by ICCIDD, UNICEF, and PAHO/WHO, together with other international organizations, have been instrumental in the success of these programs. Still, some countries need to set up a more effective structure for handling programs, monitoring, education, social mobilization, and collaboration with the salt industry. Governmental support and IEC have significantly increased in the majority of countries.

ii) Recent progress in the Americas

Since 1985 great progress has been made in the fight against iodine deficiency, particularly from an aggressive push for iodized salt use. Almost all the countries have programs for the control of IDD. The achievements to date have been remarkable and indicate that the American Region should be among the first to attain the 2005 goal of sustained elimination of iodine deficiency, as set by the United Nations General Assembly in May, 2002. In addition to Bolivia, Ecuador and Peru, external evaluations have declared three other countries to have achieved the

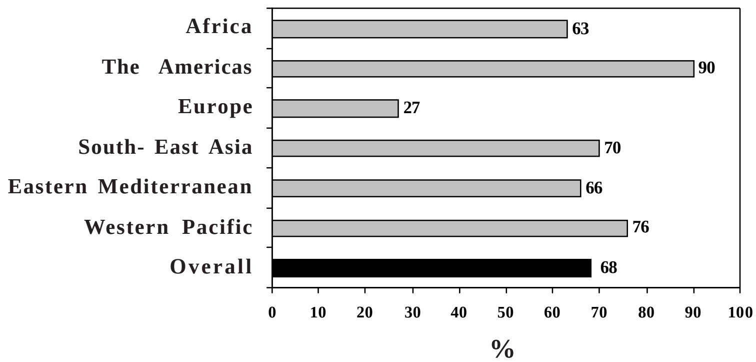


Fig. 1 *Percentage of household with access to iodized salt (WHO 1999)*

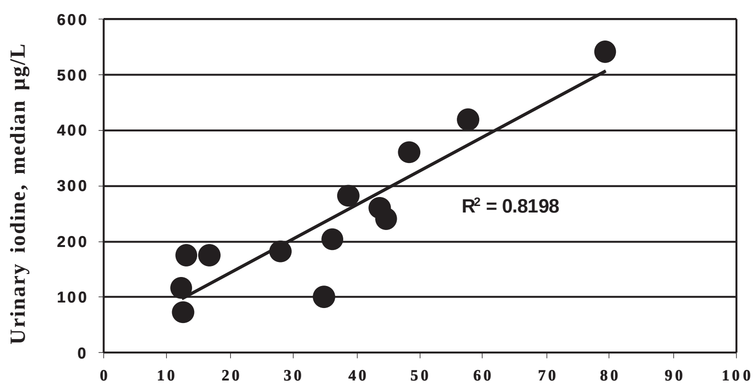


Fig. 2 *Relationship between urinary iodine and iodine in salt Iodine in salt, mean, mg/kg*

virtual elimination of IDD-Colombia in 1998, Venezuela in 1999, and Panama in 2002. Nevertheless, problems remain that prevent the effective and sustained elimination of IDD in the whole region. Of the 22 largest countries, at least 90% of households use adequately iodized salt (WHO 1999). Seventeen had a median urinary iodine concentration of at least 100µg/L (i.e., iodine sufficient). However, some countries have regressed during the past five years, and others never achieved iodine sufficiency. Still other countries have been incompletely assessed, and the risk of iodine excess has risen in more than one.

Information on the quality of iodized salt and on urinary iodine concentrations has been recently collected in collaboration with the National Representatives of ICCIDD and the officials in charge of the IDD control programs in countries (IDD Newsletter 2001). These data confirm considerable progress towards optimal iodine nutrition in the Region. At the same time, the available information is limited because it is not updated or is not reported in a uniform fashion, and the personnel responsible for it turn over frequently.

iii) Iodized salt: supply, consumption and quality

A landmark meeting in Quito, Ecuador, in April 1994, attended by high-ranking officials from UNICEF, PAHO/WHO, ICCIDD, and governments, issued a declaration, signed by representatives from 23 countries in the region, stating their commitment to universal salt iodization in the Region by the year 1995 as the mid-decade goal, to be followed by the final goal of eliminating iodine deficiency as a public health problem by the year 2000.

Currently, all countries in the region have accelerated their activities to reach the main goal of universal iodization of salt for human consumption. The legislation concerning the level of iodization of the salt has been adjusted during the last decade in seven countries where it was formerly very low or very high (Brazil, Chile, Ecuador, Mexico, Panama, Paraguay, and Venezuela), and in Uruguay, where iodized salt was required in only half the country (Pretell 2002).

Almost all the countries monitor iodized salt. Although more than 80% of salt in the majority of countries contains more than 15ppm of iodine at retail, the recommended figure of more than 90% has not been met or sustained in many. Guatemala, Dominican Republic, El Salvador, and Haiti are of particular concern. Among global regions the Americas have shown the most significant progress in iodized salt consumption

Table 1. *Iodine nutrition status*

DEFICIENT	LIKELY SUFFICIENT
Moderate	Argentina
Haiti	Belice
Mild:	Brazil
Bolivia	Canada
Guatemala	Colombia
Cuba	Costa Rica
Dominican Rep	El Salvador
Honduras	
LIKELY DEFICIENT	Mexico
Guyana	Nicaragua
Surinam	
SUFFICIENT	Uruguay
Ecuador	
Panama	**EXCESS**
Paraguay	Chile
Peru	
USA	**UNKNOWN**
Venezuela	Barbados

(fig. 1), but much remains to be improved (WHO 1999, IDD Newsletter 2003).

iv) Iodine nutrition

Urinary iodine is the most important indicator of iodine nutrition, but regular monitoring is carried out in only a few countries. For some the only data are those collected in the ThyroMobil campaign or another investigation. As presented elsewhere in this book, a median of at least 100µg/L designates iodine sufficiency in a population. While not all the countries provide top-quality iodized salt for human consumption, the median urinary iodine concentration is 100µg/L in 17 of the 22 countries, and fewer than 20% of samples have a concentration <50µg/L. Four countries have a median <100µg/L, with the Dominican Republic and Guatemala showing the lowest values. Eight countries have median values above 200µg/L, and four (Chile, Brazil, Colombia, and Venezuela) are above 300µg/L, signaling the risk of iodine excess.

The median iodine content in urine correlates with iodine levels in the country's salt **(fig 2)** reflecting variations in the level of fortification mandated by different governments (Pretell and Dunn 2002). Ecuador recently lowered the level of iodine in its salt, with a subsequent decrease in median urinary iodine concentration. A similar result occurred in Panama, but not in Chile, where the urinary iodine concentration remains high. This last situation requires further investigation.

Less emphasis is now placed on assessing the prevalence of goitre than in the past, because the palpation method is less reliable with small goitres and ultrasonography is not available in many countries. Recently, the ThyroMobil Project evaluated thyroid size in children from 13 countries of Latin America and found the goitre prevalence still above 5% in the majority of countries (Pretell et al to be published). Similar results have been found in other countries, and show that regression of goitre, even in children, may take a long time.

The American Region has progressed more towards the normalization of iodine nutrition in the majority of its countries than have most other regions of the world. The ICCIDD's last report, from data collected in 2002, estimated that 91% of the regional population (757 million) is currently iodine sufficient, but 6% (49 million) are still deficient, and another 3% (29 million) have iodine excess (IDD Newsletter 2003). According to ICCIDD's CIDDS database classification, 6 countries are already iodine sufficient and 12 are likely sufficient, but 5 have some degree of iodine deficiency, one has iodine excess, and the situation in another is unknown **(Table 1)**.

7.3

Global and Regional Activities

7.3.1 ICCIDD

7.3.2 Andean Sub-regional Program for IDD Control

7.3.3 IRLI

7.3.4 Regional Meeting, Quito 1994

7.3.5 Salt 2000 Regional Meeting Bogota, Colombia

7.3.6 Thyromobil Project in Latin America

7.3.7 International Reference Values for Thyroid Volume by Ultrasound

7.3.8 National ICCIDD Representatives

Several global and regional activities, the initiatives of various organizations, and some projects and meetings have significantly contributed to the development and progress of national IDD control programs. The following paragraphs briefly describe some of these.

7.3.1 The International Council for the Control of Iodine Deficiency Disorders (ICCIDD)

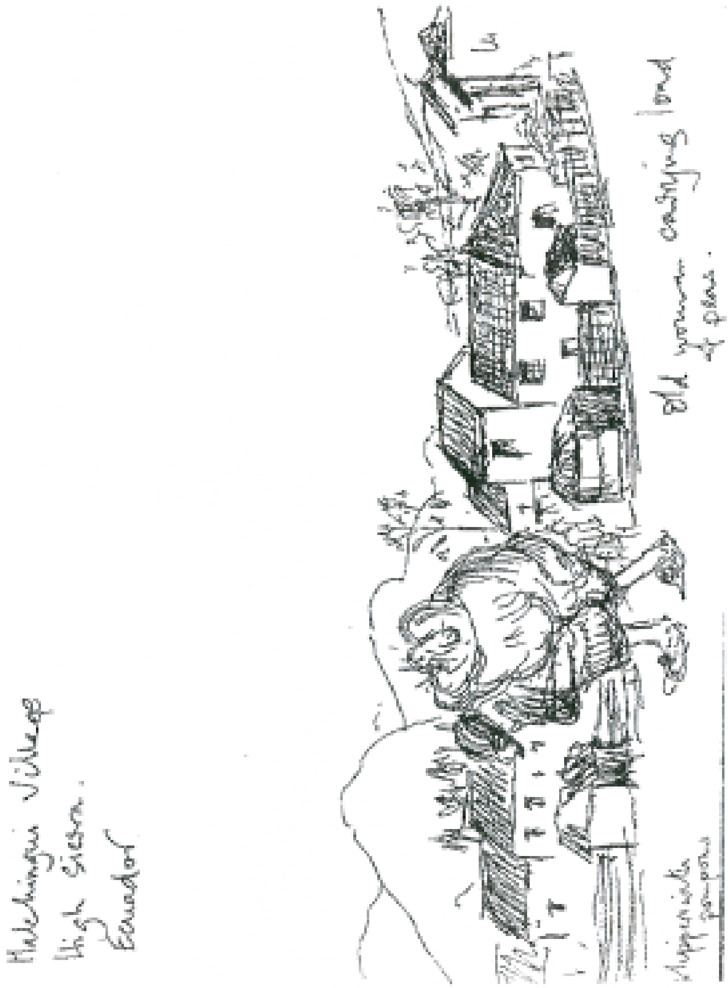
The foundation of the ICCIDD in March 1986 provided an important and decisive push for countries to abandon the neglect of iodine deficiency that had developed over decades. Even for the three countries that had already implemented IDD control programs, the emergence of the ICCIDD provided essential technical backing for their accelerated progress. Moreover, ICCIDD played a key role in developing the resolutions for IDD elimination that were eventually adopted by the World Health Assembly and the UN World Summit for Children in 1990, and these strengthened the commitments of national governments against IDD. At the regional level, ICCIDD has worked closely with PAHO/WHO, UNICEF, other partners, and governments to present a united front towards optimal iodine nutrition and effectively iodized salt.

7.3.2 The Andean Sub-Regional Program for IDD Control

This venture was founded by UNICEF with the collaboration of PAHO/WHO and ICCIDD and financial support from the Belgian Government. The original members were Bolivia, Colombia, Ecuador, Peru and Venezuela, joined later by Paraguay. Its objective has been to assist the country members to reach the goal of the World Summit for Children. Its main activity has been to promote the exchanges of methodology and experiences among countries in IEC, social marketing, salt iodization technology, epidemiology, and monitoring. It proved effective in strengthening the IDD control programs of individual countries, as is demonstrated by the success of five of them in reaching the goal of iodine sufficiency.

7.3.3 Interlaboratory Program for Urinary and Salt Iodine Assay, and the IRLI Network

Because urinary iodine is the most important indicator of iodine nutrition, the reliability of involved laboratories is important. To this end, the Andean Sub-regional Program for Control of IDD initiated a trial in 1998 that currently continues through a partnership with the Regional


High Sierra.
Ecuador
Old woman carrying load
of peas.

ICCIDD office. Originally, the network included only laboratories of the five Andean countries, but now it comprises a total of 20 laboratories in the Latin American countries, most of them collaborating with the national IDD control programs, but having no previous external quality control. This activity has become a very important way to improve the capacity for monitoring the impact of strategies for IDD elimination, and the Regional ICCIDD laboratory has continued to offer training and consultation to labs throughout the hemisphere.

Most recently, the participation of ICCIDD in the new International Resource Laboratories for Iodine (IRLI) Network offers further opportunity to contribute to the quality and efficiency of these other laboratories. Two laboratories in the region have been selected to integrate the IRLI Network, one in Guatemala, at the Food Safety and Fortification Area, INCAP, and the other in Peru, at the Endocrinology and Metabolism Unit, High Altitude Research Institute, Cayetano Heredia Peruvian University.

7.3.4 Regional Meeting on Universal Salt Iodization for the Elimination of Iodine Deficiency Disorders in the Americas

This meeting in Quito Ecuador, April 9-11, l994 gathered senior representatives of countries, international organizations (especially UNICEF, PAHO, and ICCIDD), and various sectors relevant to IDD, particularly the salt industry. All pledged to work together in the Region to achieve universal salt iodization and IDD elimination. The meeting culminated with the Quito Declaration on Universal Salt Iodization, signed by the representatives of 23 countries. This provided added impetus for the regional salt iodization effort.

7.3.5 Salt 2000 Regional Meeting, Bogotá, Colombia

Representatives of the salt industry, the national IDD control programs from 22 countries, and the international agencies (including PAHO, UNICEF, ICCIDD, Kiwanis, MI, PAMM) gathered to recognize the leading role of the governments through their IDD control programs for the success achieved so far in the elimination of IDD, as well as the important role played by the private sector, the salt industry. While acknowledging the significant progress achieved towards USI and the consumption of iodized salt in the majority of countries, the group noted a widespread weakness in sustainability. It recommended that the salt industry must secure QA not only among the large-scale producers but also the medium and small ones, and that legislation and regulations must be updated to provide a daily intake of 150µg of iodine. Governments were urged to renew their commitments to sustain elimination of IDD by implementing and/or maintaining effective IDD control programs and taking a more effective role in the inspection and enforcement of the legislation for salt iodization.

A Declaration was drafted at the end of the meeting. Its key recommendations were to:

1) Encourage the industry to produce and distribute high quality iodized salt at a reasonable price;
2) Pursue permanent political will for supporting IDD programs;
3) Maintain regular monitoring of iodized salt quality and its effects in human nutrition;
4) Develop social mobilization programs to encourage consumption of iodized salt;
5) Create a trust fund for implementing regional communication programs on iodized salt consumption; and
6) Include instruction on iodine deficiency and iodized salt use in the educational system.

7.3.6 The ThyroMobil Project in Latin America

The collaboration between ICCIDD and private industry (Merck) has provided standardized rapidly available data on iodine nutrition in 13 Latin American countries. It has charted the progress of USI, showing that areas of deficiency and excess persist, as does wide variation in the level of salt iodization from heterogeneity in the relevant legislation. But also, very importantly, the project has also helped to reinforce commitments towards the sustainable elimination of IDD, to increase awareness of IDD, to promote the implementation of monitoring systems and to encourage the active participation of health authorities, academic, medical, and scientific institutions, and the mass media for the common goal. In some countries where the support of Merck was not available, the project received financial support from the local UNICEF offices and health authorities.

7.3.7 International reference values for thyroid volume by ultrasound

Under the sponsorship of WHO the Regional ICCIDD Office has participated in a multinational project to develop reference values for thyroid gland volume by ultrasound in school-age children from areas of long-standing iodine sufficiency. These criteria can now be used to define goitre for IDD surveillance. The study was carried out in collaboration with other ICCIDD colleagues at 6 sites selected from the

Americas, Europe and Western Pacific: Manama, Bahrain; Tokyo, Japan; Lima, Peru; Zurich, Switzerland; Boston, USA; and Cape Town, South Africa.

7.3.8 National ICCIDD Representatives

Since 1995, ICCIDD has appointed National Representatives to work with their governments and promote awareness of iodine nutrition and iodized salt in their countries. Currently there are representatives in 10 Latin American countries and others are being recruited. ICCIDD regards these nationals as key players in the drive to create National Coalitions for Optimal Iodine Nutrition and to promote sustainability that will outlast changing personnel and priorities in governments and agencies.

7.4

Summary of Regional Experience

1. Most of the Western Hemisphere's previously severe iodine deficiency has been corrected. At least 80% of salt at retail is adequately iodized, and only 4 countries (Guatemala, Dominican Republic, Haiti, and Bolivia) have median urinary iodine concentrations in the deficient range.
2. The achievements so far reflect effective collaboration among many partners, both national (governments, especially Ministries of Health, Education, and Commerce, the salt industry, the health sector, consumers, and advocacy groups) and international (ICCIDD, UNICEF, PAHO/WHO, Kiwanis, bilateral donors, private foundations, and others). This collaboration offers a useful model for tackling other health issues.
3. Some countries need watching for iodine excess from unnecessarily high levels of iodine in salt.
4. Monitoring of iodine in people and in salt is still non-existent, fragile, or inadequate in many countries.
5. The great challenge now is sustaining the progress. The failures after previous success in the past decades in Latin America emphasise the perils of relaxed vigilance. For example, recent data from Bolivia show a decline in salt iodization and the threat of returning iodine deficiency, after previously achieving sufficiency.
6. Key elements for sustainability are national coalitions and effective education at all levels. Each country must take long-range responsibility for its own program to achieve permanent optimal iodine nutrition.

7.5

The Peru Country Program

7.5.1 Background

7.5.2 Public Health Action

7.5.3 Baseline IDD Situation

7.5.4 Plan of Action

7.5.5 Political and Economic Support

7.5.6 External Evaluation of the Program

7.5.7 Guarantee of Sustainability

7.5.1 Background

The elimination of iodine deficiency as a public health problem in Peru took place in three well differentiated stages over more than a half a century, since a law mandating the iodization of salt was approved in 1940.

Severe endemic goitre and cretinism were recognized in the sierra and jungle regions during colonial times but they must have existed there long before because iodine deficiency, its main cause, is a permanent natural phenomenon there. Many early explorers described the frequent occurrence of goitre, and its presence before and during the Incan rule of 1150-1533 has been documented; the Quechua natives had the words *coto* and *opa* to describe goitre and cretin, respectively. The disease was clearly prevalent during colonial times (1533-1821), when a Papal Bull of Pope Paul III (1534-1549) ordered missionaries to consider goitrous and cretinous people as beings with souls and worthy of conversion to Christianity. After Independence and during the first half of the 20th Century, many studies, chiefly epidemiological, confirmed the severity and magnitude of the endemia and its relation to low environmental iodine, but the problem received little attention (Lastress 1954, Pretell 1989).

A renewed interest in IDD emerged in the late 1940s and 1950s. Iodization of salt was legislated, the Unit of Endemic Goitre was created in the MOH, and six iodization plants were started in different Departments affected by iodine deficiency. Unfortunately this effort did not have the necessary economic and governmental support, and vanished within a decade, leaving no impact.

The 1950s brought new knowledge on thyroid patho-physiology and the effects of iodine deficiency in Latin America, pioneered by Dr. John Stanbury, later the founding Chair of ICCIDD. Under his influence, we started, in 1966 at the Cayetano Heredia Peruvian University in Lima, to reinvestigate the problem of iodine deficiency in the country. Along with epidemiological investigations that confirmed the persistence and severity of endemic goitre and cretinism in the country, three studies were particularly important because they demonstrated the deleterious effect of iodine deficiency on the quality of life, the urgent need for its elimination, and the availability of new methods for prophylaxis, treatment, diagnosis, and monitoring.

a) *Effect of iodine deficiency on the maternal-fetal unit*-This study clearly demonstrated that iodine deficiency caused a high rate of maternal hypothyroidism, strongly suggesting a low placental transfer

Fig. 1 *A family group of five brothers and sisters all goitrous*

Fig. 2 *A group of neurologic and myxedematous cretins from the same village*

of iodine and thyroid hormones to the fetus, and also an increased abortion rate and low iodine concentration in maternal milk, and on the fetal side, the occurrence of about 15% congenital hypothyroidism, impaired mental and neurofunctional development, and increased perinatal mortality (Pretell and Stanbury 1971, Pretell 1973, Pretell et al 1974: Pretell and Caceres 1994).

b) *Use of iodized oil in the prophylaxis and treatment of IDD*- The fate and effects on thyroid function of various doses of intramuscular iodized oil injections, as well as its oral administration, were investigated over a five year period (1966-1972). This new method proved of great benefit for its immediate and long lasting effect-3 to 5 years intramuscularly and 6 to 12 months orally. It was safe in pregnant women, effective in preventing fetal brain damage, and easy to administer (Pretell et al 1969). Complementary experimental studies demonstrated storage in fat tissue independent of the thyroid (Pretell 1972, Hubner and Pretell 1981). The method has been recommended in high-risk populations (Pretell et al 1974, Stanbury et al 1987).

c) *Urinary iodine as an indicator of iodine nutrition*-The iodine concentration in casual urine samples was investigated and extensively validated as the most important indicator for defining the degree of iodine deficiency in a given area, as well as for monitoring the results of control programs (Medina 1989).

7.5.2 Public health action

The above results argued strongly for public health action. We convinced the authorities at the MOH of the urgent need to fight IDD, and in 1983 a Supreme Decree created the Endemic Goitre Office, which later became the National Program for the Control of Endemic Goitre and Cretinism (Pretell 1987, Pretell 1989) with support from the MOH and the Joint PAHO/WHO-UNICEF Nutritional Support Program, funded by the government of Italy.

7.5.3 Baseline IDD Situation

The Program reached full implementation in 1985. Its first task was to carry out a national survey to evaluate the actual IDD situation and its relevant features. When the survey was completed in 1986, the country's total population was 19.9 million, with 9.5 million in the sierra and jungle regions.

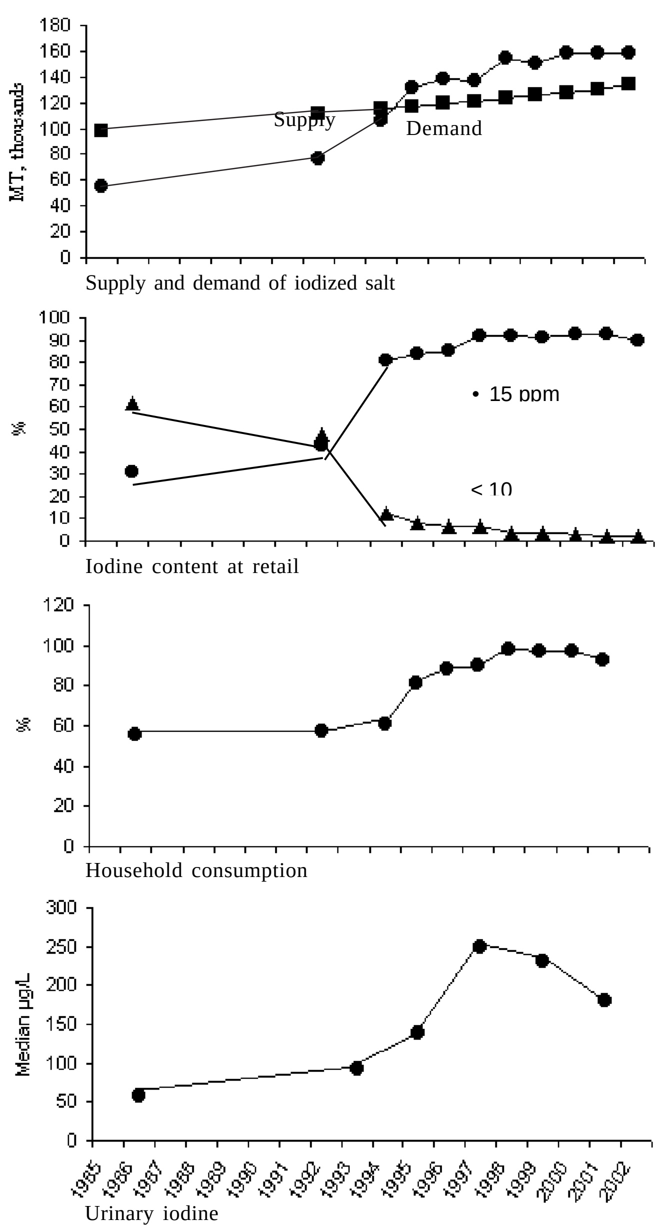


Fig. 3 *Monitoring changes in iodized salt production, quality and consumption, and in urinary iodine*

Table 1. ***Components of Peru's strategic plan of action***

Component	1986-78	1989-92	1993-95	1996-00	2002
Network Organization & training	+++	+++	+++	+++	+++
Coverage of pop at high risk with iodized oil	+++	++	+	+	
Progressive USI	+	++	+++	+++	+++
Monitoring and surveillance system	++	+++	+++	+++	
IEC	+++	+++	+++	+++	++
Social Marketing	++	+++	++	+	
Advocacy	+++	+++	+++	+++	+++

The survey covered 136 of the country's 184 provinces in 23 Departments, and included 775 villages. The results showed that goitre was endemic in 87 % of the villages, with a total goitre rate of 36.4 %. The median urinary iodine was 71µg/L with 36.8 % of the values <50µg/L. The impact of the severity of the iodine deficiency on the affected population is illustrated in **figures 1** and **2**. The production and marketing of iodized salt was being carried out by the government mainly in two factories near Lima, the capital city on the coast. The annual production of iodized salt covered only 57% of the country's need, and was mainly distributed to the coastal region; only 30.8% of salt at the retail level contained >15ppm iodine. An additional complicating factor was the ignorance of the population, including the health and education personnel, about the cause and the importance of IDD; only 40% of household leaders recognized goitre and cretinism as diseases, and less than 10% related them to iodine deficiency.

The extensive use of urinary iodine as the main indicator permitted a more precise assessment of the degree of deficiency, and also showed that the northern and southern sierra were the more severely affected, with median UIs of 57µg/L and 56µg/L, respectively. The population at risk was estimated at about 6 million.

7.5.4 Plan of action

The survey results led to a new plan of action **(Table 1)**. This strategic model has proven highly successful in that it initially achieved the immediate protection of the population at risk of severe and high IDD by iodized oil administration, and at the same time moved progressively towards universal iodized salt fortification while building the bases for its sustainability. Some of the major features are described in the following paragraphs.

a) *IDD network* - This key component of the Program was created at the very beginning to have both a central management unit and a field organization that includes 29 Regional and Sub-regional Coordinators as well as 156 Local Coordinators at primary health care establishments. The regional health workers are motivated and well trained. All personnel undergo frequent retraining and hold annual meetings to review progress, difficulties, new guidelines, and updated scientific knowledge on IDD. The Program's work is also

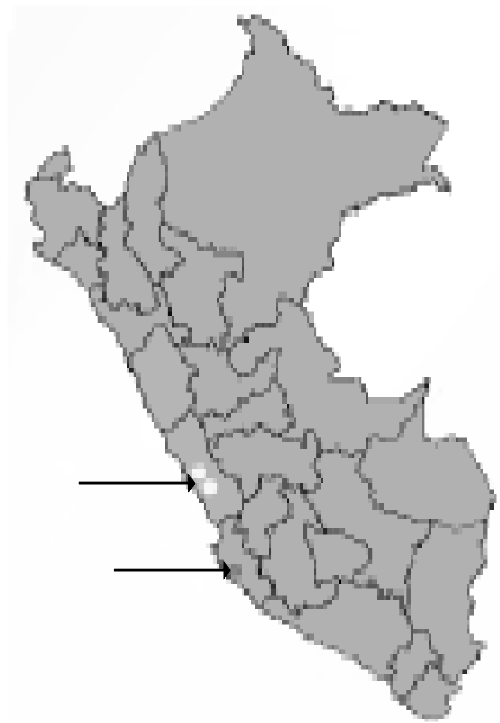


Fig. 4 *Location of Salt Plants*

Table 2. *Urinary iodine and goitre prevalence in Peru*

Urinary Iodine						GoitrePrevalence
Year	**Median**	**Frequency of medians %**				**%**
	µg/L	**<100**	**100-200**	**201-300**	**>300**	
1986	72	66.9	20.8	6.9	5.4	36.4 (P)
1993	92	51.4	32.4	13.5	2.7	
1995	139	26.1	52.2	19.6	2.2	
1996						10.8 (P)
1997	250	6.0	23.9	47.8	22.4	
1998						12.4 (US)
1999	230	4.4	36.7	32.2	26.7	
2001	180	10.4	46.3	28.3	14.9	

(P) palpation - (US) ultrasound

supported by other government agencies, such as the Ministries of Education, Industry and Agriculture, and local governments.

b) *Protection of the high risk population*-Since it would take time to provide enough iodized salt to cover the whole population, as well as to achieve acceptance of its consumption, the Program decided to protect the population at higher risk immediately with iodized oil, and about 2 million people in 83 provinces were injected during the period 1986-1987. During the following years this protection (by injection or orally) was administered to progressively fewer people in places still not reached by iodized salt, until it could be discontinued in 1996.

c) *Salt iodine*.- At the same time, a strong effort was made to increase the production and the consumption of iodized salt and to improve its quality by the following steps **(fig. 3)**:

i) *Production and coverage to meet population demand* - During the first six years, while the salt industry was still a governmental monopoly, the production of iodized salt increased steadily, but slowly. It was only after 1992, when the industry became private, that a significant and sustained increase occurred. Since 1995 the supply of iodized salt in the market has surpassed the population demand. Currently there are 52 salt plants including the 2 previously existing large producers on the coast, and 50 small producers mainly located along the northern coastal area and in the southern sierra **(fig. 4)**. About 75% of the iodized salt for internal consumption in covered by the large plants. The small producers receive continuous technical assistance provided by the MOH.

ii) *Quality of iodized salt* - In addition to providing enough iodized salt, the quality of the salt has improved, and for the past 6 years more than 90% of the salt at retail contains at least 15mg/kilo of iodine. Monitoring of salt quality at the production level has been necessary only at the small plants. Monitoring at retail level is constant and systematic, collecting a large number of representative salt samples for analysis of iodine at 15 laboratories distributed throughout the country.

iii) *Household consumption*-Surveys on the consumption of iodized salt have been carried out yearly since 1994, either through home visits or by asking school children to bring salt samples from their homes to the school, where the iodine content is tested with certified

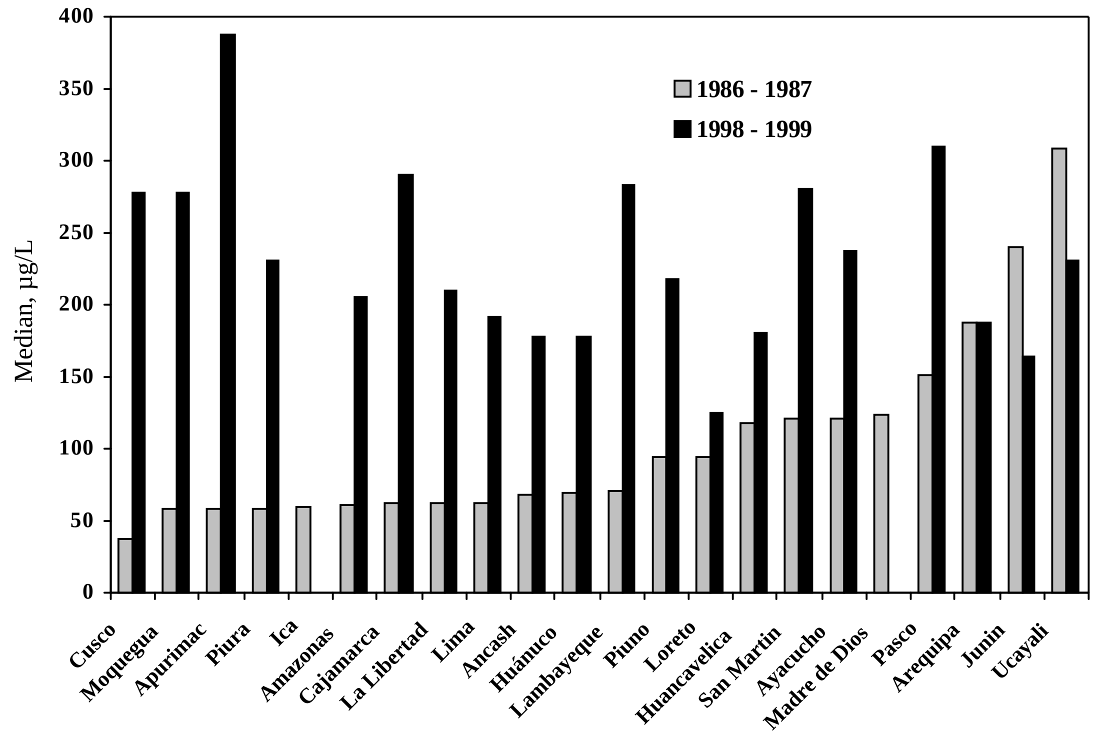


Fig. 5 *Changes in urinary iodine concentration in Peru by Department*

semi-quantitative kits produced in the country. The results reveal an important change in the population's attitude, so that iodized salt is no longer rejected, with the result that during the last five years adequately iodized salt is consumed by more than 90% of households.

iv) *Urinary iodine*-The median iodine concentration in the urine has been the main indicator for the Program to monitor iodine nutrition. Its results clearly demonstrate the progress achieved in all areas of the country. The national median has stayed above 100ug/L since 1995 **(fig. 5)**, and a breakdown of the results by Department clearly shows normal iodine nutrition in all of them **(fig. 6)**. At the beginning the medians showed a transitory risk of iodine excess, but this situation is now normalizing **(Table 2)**.

Representative urine samples are collected every two years and analyzed for iodine content in the laboratory of the Metabolic and Endocrine Unit, High Altitude Research Institute of Cayetano Heredia University, a designated referral lab of the IRLI Network.

v) *Information, education, communication, and advocacy*-These activities are considered highly important for strengthening knowledge about IDD and actively engaging the community in preventive measures. Most of the educational material is produced by local teams to encompass the cultural background of the target population. An extensive social marketing strategy was applied in the Program from 1993 to 1999 and significantly improved the consumption of iodized salt. It was addressed particularly to the salt production and marketing chain, the health, education, agricultural and industry sectors, the media, local authorities, police, opinion leaders, and mothers' clubs.

7.5.5 Political and Economic Support

From the beginning, the political and economic support of the government has been a key factor in the Program's success. In accordance with the commitment made by the country at the 1990 World Summit for Children, IDD was first included in the 1992-1995 National Plan of Action for Children, and its sustained elimination is now part of the Political Plan of the MOH for the period 2002-2012. The government covered approximately 50% of the Program's budget until 1995 and about 90% since 1997. UNICEF, ICCIDD and PAHO/WHO have also provided economic and technical support.

7.5.6 External Evaluation of the Program

At its request, the Program has been evaluated twice by international teams of experts from PAHO/WHO, ICCIDD, UNICEF and PAMM. The first evaluation took place in 1996 and reported that the goal of universal salt iodization had been achieved (Ministerio de Salud 1996). The second evaluation, in l998, confirmed the sustained virtual elimination of IDD in Peru, and the country then received a joint PAHO/WHO-UNICEF-ICCIDD Recognition Award for this achievement (Ministerio de Salud 1998).

7.5.7 Guarantee of Sustainability

The sustainability of IDD elimination in Peru is based on the following existing conditions:

1. Organization and infrastructure of the Control Program.
2. A highly qualified central team at the MOH and a national network in 34 Regional Health Directorates.
3. Political and financial backing from the government, and multisectoral support.
4. Integration of all the Program's activities within the MOH's national plan.
5. An active monitoring and surveillance system for iodized salt, urinary iodine and goitre prevalence.
6. Qualified laboratory facilities, including 15 decentralized regional labs for iodized salt control.
7. Full cooperation and support from the salt industry.
8. Technical support from PAHO/WHO, UNICEF, and ICCIDD

7.6

Conclusions

1. The IDD Control Program of Peru began in 1986 in the sierra and jungle regions, where severe iodine deficiency had been demonstrated previously.
2. The Program's strategic plan of action included the immediate protection of the population at high risk with iodized oil and a progressive increase in the production and consumption of iodized salt. At the same time a well-trained and highly motivated national network was developed, and its work was amplified by intensive IEC, advocacy and marketing support.
3. Since 1995 the supply of iodized salt has exceeded the population demand, and adequately iodized salt has been consumed by more than 90% of households for the past five years.
4. The median urinary iodine concentration, the best impact indicator of iodine nutrition, has stayed above 100µg/L since 1995.
5. The prevalence of goitre has significantly decreased; it is still above normal, but its persistence is typical of areas that have once had iodine deficiency.
6. Important factors in the program's success are the systematic monitoring of iodine in salt and in the population, and the political and economic support of the MOH.
7. Peru has succeeded in the sustained elimination of IDD with a control program that can serve as a model for other countries.

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8

European Region

F Delange, G. Gerasimov

8.1

Iodine Deficiency Disorders (IDD) in Western and Central Europe

F. Delange, H. Bürgi and B. Moinier

8.1.1 Summary and Lessons Learnt

8.1.2 Epidemiology

8.1.3 Public health consequences of iodine deficiency in Europe

8.1.4 Prevention and therapy of IDD in Europe

8.1.1 Summary and Lessons Learnt

The national representatives from the West and Central European Region of the International Council for Control of Iodine Deficiency Disorders (ICCIDD) met on 7th September 2002, in Goteborg, Sweden and designated 15 countries iodine sufficient, 13 deficient, 4 likely sufficient and 1 likely deficient **(Table 1)**. Overall, more than 60% of the nearly 600 million people in the region live in countries that harbour iodine deficiency (Vitti et al 2003).

The national representatives went on to state that "national responsibility for iodine nutrition and its prophylaxis is weaker in most European countries than elsewhere in the world. Awareness of the importance of iodine deficiency can be underestimated in countries without assessment and monitoring programs and unrecognised pockets of deficiency might exist in remote areas. Laws with respect to iodized salt vary widely in Europe, as do the types and amounts of iodine compound used for fortification.

Several actions should be implemented to eradicate iodine deficiency in Europe. Methods for effective monitoring programs should be standardised. If Voluntary use of iodized salt does not result in iodine

Table 1. *Iodine nutrition status by country, based on median urinary iodine excretion (µg/L)*

Sufficient (>100µg /L)	Likely Sufficient	Deficient (<100µg/L)	Likely Deficient
Austria	Iceland	Belgium	Albania
Bosnia	Luxembourg	Denmark	
Bulgaria	Norway	France	
Croatia	Sweden	Germany	
Cyprus		Greece	
Czech Rep		Hungary	
Finland		Italy	
Macedonia		Ireland	
Netherlands		Montenegro	
Poland		Romania	
Portugal		Slovenia	
Slovak Rep		Spain	
Serbia		Turkey	
Switzerland			
UK			

sufficiency strong consideration should be given to making supplementation compulsory. The high costs of iodized salt in some countries, together with low public awareness of its importance, are causes of poor acceptance by consumers and should be corrected.

ICCIDD and its partners can help countries achieve iodine sufficiency by:

- Providing models of successful legislation already in place in a few countries (such as Austria).
- Assisting the formation of national coalitions to address iodine nutrition
- Offering guidelines for Europe-wide standardised programs for monitoring both iodine nutrition and the quality of iodized salt and'
- Recommending a uniform content of iodine for salt fortification.

Many of these issues should be addressed together with WHO and UNICEF through the European Union and in cooperation with groups such as the European Thyroid Association, National Endocrine Societies and the European Salt Producers Association. Countries without a national committee for iodine nutrition should be encouraged to form one that includes representatives from the national health authority, nutritionists, endocrinologists, paediatricians, epidemiologists and salt producers.

More than half of the population in Western and Central Europe is at risk of iodine deficiency and most nations have weak or non-existent governmental programs to address this problem. Consequently, much of the responsibility is shouldered by others, especially thyroidologists, the health sector, academic institutions and the salt industry. National coalitions of these groups can and should play a major part in achieving the sustaining optimum iodine nutrition in the continent. It is remarkable that Europe donates substantial funds towards the elimination of iodine deficiency in the developing world, but has not yet corrected its own."

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Vitti, P. Delange, F. Pinchera, A. Zimmermann, M. Dunn, JT. (2003) Europe is Iodine Deficient. The Lancet 361: 1226.

8.1.2 Epidemiology

Endemic goitre, frequently complicated by endemic cretinism, has been reported from Europe for centuries, especially from isolated and mountainous areas, for example from Switzerland, Austria, Italy, France, Bulgaria and Croatia (Merke 1984). IDD has been entirely eradicated in

Switzerland thanks to the implementation and sustained monitoring of a program of salt iodization (Burgi 1990). Probably because of the impact of this remarkable program on the medical world and also because legislations on iodized salt had become available in many additional countries, IDD seem no longer to have been considered an important public health problem in Europe during the next decades.

In 1960, the WHO published an exhaustive review on IDD in the world entitled 'Endemic goitre' (Kelly and Snedden 1960). Although this document included preliminary reports on Western countries, the information was scanty for the former USSR and especially for the Central Asia Republics, which are presently recognized as severely affected (Delange et al 1998).

It is only in the late 1980s that the European Thyroid Association, in its reevaluation of the problem, clearly indicated that, with the exception of the Scandinavian countries, Austria and Switzerland, most of the European countries or at least certain areas of these countries were still affected, especially in the Southern part of the continent (Gutekunst and Scriba 1988). This survey confirmed a lack of information on IDD from countries of the eastern part of the continent. Shortly thereafter, it was appreciated that the fœtus, neonate and young infant were the most susceptible targets for iodine deficiency and the term '**endemic goitre**' evolved into the broader contept of '**iodine deficiency disorders**' (Hetzel 1983). Studies conducted in Europe revealed that iodine deficiency in adults was accompanied by a similar and certainly more damaging degree of iodine deficiency in the neonates and in their mothers, especially during breast-feeding (Delange et al 1986).

As indicated earlier in this volume (see Section II), a series of major decisive meetings took place in the early 1990s, including the World Health Assembly (Geneva 1990) the World Summit for Children (New York 1990), the Policy Conference on Ending Hunger (Montreal 1991) and the International Conference on Nutrition (Rome 1992). At these meetings, WHO and UNICEF committed themselves to the virtual elimination of iodine deficiency disorders in the world, including Europe, by the year 2000. In 1994, WHO, UNICEF and ICCIDD jointly published (and later updated) a technical document entitled Indicators for assessing iodine deficiency disorders and their control through salt iodization. It has become the reference document for members of the health system, salt industry and national and international organisations and agencies in charge of the elimination of the disorders (WHO/UNICEF/ICCIDD 1994, 2001).

The next crucial evaluation of IDD in Europe took place in 1992 when, thanks to recent changes in the political situation, the status of iodine nutrition could be reevaluated in all European countries including the Eastern part of the continent (Delange et al 1993). An international workshop entitled Iodine deficiency in Europe: a continuing concern' organized by one of the authors of this chapter (FD) and his colleagues under the sponsorship of the European Commission, the ICCIDD and the Belgian Foundation for Medical Research was organized in Brussels. One representative from each European country summarized the latest IDD data from his country including the preventive measures.

Fig. 1 summarises the results reported during the workshop on iodine supply in Europe as at 1992. Iodine deficiency was under control in only 5 countries, namely Austria, Finland, Norway, Sweden and Switzerland. Iodine deficiency was marginal or present mainly in pockets in Belgium, the Czech and Slovak Republics, Denmark, France, Hungary, Ireland, Portugal and the United Kingdom. IDD had recurred after transitory resolution in Croatia, The Netherlands and possibly some Eastern European countries including Russia. Finally, iodine deficiency persisted and varied from moderate to severe in all the other European countries.

In 1997, a follow-up meeting entitled 'Elimination of iodine deficiency disorders (IDD) in Central and Eastern Europe, the Commonwealth of Independent States, and the Baltic States' was organised in Munich under the auspices of ICCIDD, UNICEF and WHO (Delange et al 1998). It provided an overview of IDD status, control programs and salt supplementation in the 28 countries of this region. It emphasised the severity of the problem in many parts of Eastern Europe, including recurrence of goitre and occasionally of endemic cretinism in some countries such as Russia after interruption of former programs of salt iodization. The governments of the affected countries, their national delegates, the regions and sub-regions, agencies and non- governmental organisations all received appropriate recommendations. This meeting triggered massive efforts in the implementation or restitution of iodized salt programs, mainly by UNICEF with the financial support of Kiwanis International.

Since these two reports, an increasing number of publications has become available on various aspects of IDD and its control in European countries based on local or regional surveys, for example in Austria, Germany, Hungary, Italy, Portugal (The Euro-Growth Study) (Manz et al 2000), the Netherlands (Brussaard et al 1997), Ireland (Smyth et al 1997), Spain (Garcia-Mayor et al 1999).

Fig. 1 *Evaluation of iodine intake in Europe (μg/day) in 1992. Range of the values observed during regional or national surveys. The figures correspond to the measurement of the daily urinary excretion of iodine or to the extrapolation to 1 L of urine per day when the results were expressed as iodine concentrations or iodine/creatinine ratios. N: Norway; S: Sweden; SF: Finland; DK: Denmark; IRL: Ireland; UK: United Kingdom; B: Belgium; NL: The Netherlands; G: Germany; Pl: Poland; CS: former Czechoslovakia; CIS: Commonwealth of Independent States; F: France; CH: Switzerland; A: Austria; H: Hungary; RO: Romania; P: Portugal; E: Spain; I: Italy; CRO: Croatia; BG: Bulgaria; GR: Greece; AL: Albania; TR: Turkey (Delange et al. 1993).*

A limited number of countries have re-assessed IDD on a national basis. An interesting case is Denmark, the only country in which iodized salt was prohibited until 1999 (Burgi et al 1993). Paradoxically, it was the high incidence of hyperthyroidism in the elderly (due to autonomous nodules in multinodular iodine deficiency goitres) that constituted the starting point for a very cautiously monitored program of salt iodization (Laurberg et al 1998) (See further below in this chapter). Germany was the first country to use a method of standardised evaluation of thyroid volume and prevalence of goitre by ultrasound (Hampel et al 1995). A van with sonographic equipment visited 32 regions all around the country and examined almost 6,000 individuals aged 1-90 years This 'ThyroMobil model' was further fitted for systematic collection of urine samples for iodine determination. It turned out to be one of the most efficient intruments for monitoring progress towards the elimination of IDD (Delange et al 2001; Dunn 2001). The Netherlands reached adequate iodine nutrition after phases of iodization of water and salt, especially for the bakery industry (Brussaard et al 1997; Wiersinga et al 2001), Belgium (Delange et al 2000) and France (Valeix et al 1999) are among the very few European countries with no enforced programs of salt iodization so far and which remain similarly affected by mild iodine deficiency, while Poland has achieved remarkable progress (Szybinski et al 2001). Croatia (Kuzic et al 1997), Macedonia (Karanfilski et al 1998) and Turkey (Erdogan et al 2001) recorded substantial progress, especially after salt iodization was declared mandatory.

The key point is that of these European countries which were deficient in 1992, only The Netherlands, Bulgaria and Macedonia seem to have reached iodine sufficiency by 1999.

Based on these different technical and scientific contributions, WHO Euro adopted the elimination of IDD as one of its targets in its nutrition plan in 1999 (WHO Europe 2000). This was specified in an action plan for sustainable elimination of IDD introduced by one of the authors of this chapter (Delange 2000). This plan has the following components:

- Maintain and develop advocacy, training, communication, and operational research on IDD.
- Perform an ongoing detailed evaluation of the extent of IDD in Europe.
- Implement Universal Salt Iodization if not yet achieved wherever IDD is documented ensure and control its availability, technique, legislation and quality control.
- In the meantime, organise the administration of iodized oil in areas hard to reach with severe IDD.

- Implement iodine supplementation during the perinatal period and up to three years of age in areas with mild and moderate IDD.
- Ensure quality control and monitoring of the programs of iodine supplementation from the producer to the consumer : implement and/ or control the indicators, through reference laboratories, of the iodine and salt intake of the populations The promotion of iodized salt should not result in an increase of salt intake. The necessary monitoring of iodine intake through salt iodization is a unique opportunity to evaluate and monitor salt intake and to respect the WHO recommendation to maintain or decrease the salt intake at healthy levels.

In 1999, WHO, with the support of UNICEF and ICCIDD, published a world report on Progress Towards the Elimination of Iodine Deficiency Disorders. The document reviewed the remarkable progress achieved on a world scale. It summarized for each affected country presently available information on legislation, control and market share of iodized salt, as well as monitoring the iodine status of the populations. Based on this document, 18 of the 31 countries of Western and Central Europe are affected by IDD. At least 3 additional countries should be added to the list, namely Denmark, Ireland and France. Thus, only a limited number of European countries affected by IDD are able to report access to iodized salt at household level of at least 90% of the population, which is one of the criteria required for being allowed to declare IDD under control. Europe is now the last continent to provide iodized salt to its iodine deficient populations (WHO/UNICEF/ICCIDD 1999).

Recent updates giving full details of country programs have been provided in the IDD Newsletter (November 2002).. Reference to this source is recommended for more detailed information.

8.1.3 Public health consequences of iodine deficiency in Europe

The state of mild to severe iodine deficiency persisting in many European countries or regions has important public health consequences, including on the intellectual development of infants and children. As an example, **Table 2** summarizes the situation in Belgium where the consequences of mild IDD on the main target groups, i.e. pregnant and nursing women, neonates and young infants, have been extensively investigated.

More generally speaking, the consequences of iodine deficiency in Europe can be summarised as follows:

In adults: the frequency of simple goitre is elevated in many countries and the cost of therapy of thyroid problems resulting from iodine deficiency in the adult population is enormous. For example, the cost for the diagnosis and treatment of goitre due to iodine deficiency in Germany for the year 1986, was estimated at 900 million DM (approximately $500 million, or $8 per inhabitant per day) (Pfannenstiel 1985), while prevention

Table 2. *Functional consequences of mild iodine deficiency in Europe. The case of Belgium*

Age Groups	Recommended Iodine intake (µg/day)	Recommended Urinary iodine Concentration (µg/L)	Actual urinary iodine concentration (µg/L)	Functional consequences
Pregnant Women	200	200-300	<100 in 90% of the cases	Increased thyroid stimulation Goitre
Adults	150	100-200	51-60	Elevated thyroidal uptake of radioiodine
Adoles-cents	150	100-200	30-50	Puberty Goitre
Children 6-12 years	120	100-200	55-80	Goitre (by ultrasounds 6-11% (18.4% in girls ages 12 years
Infants 6-36 months	90	180-220	101 <in 81% of the cases	Risk for future intellectual development
Neonates	90	150	48-86 < in 68% of the cases	Elevated serum TSH and Tg on cord blood

by iodized salt would cost only 2-8 US cents per inhabitant and per year. Thyroidal uptake of radioiodine varies markedly from one European country to another and is inversely related to the iodine intake. Elevated thyroidal uptake due to iodine deficiency aggravates the risk of thyroid irradiation and development of thyroid cancer in case of a nuclear accident (Delange 1990). The best prophylaxis of nuclear hazards in case of radioiodine fallout is to increase the basal intake of iodine of the population (Ermans 1993).

Thyroid function is usually normal in adults in European countries with borderline or low iodine supply. By contrast, it is frequently altered in pregnancy (Glinoer 1997).

At least under conditions of borderline iodine intake such as in Belgium (urinary iodine 50-70µg/day), pregnancy is accompanied by a progressive decrease of serum free T_4 and consequently by an increase of serum TSH. This state of chronic TSH hyper-stimulation results in the development of goitre in about 10% of the pregnant women and in a progressive increase in the serum concentration of thyroglobulin. Goitre can persist after pregnancy in a significant number of women. Pregnancy, especially in conditions of borderline iodine intake, at least partly explains the higher frequency of thyroid problems in women than in men.

The consequences of marginal iodine deficiency during pregnancy in Belgium on the thyroid function of the neonate include even more elevated serum levels of TSH and thyroglobulin in cord blood than in the mothers and a slight enlargement of the thyroid gland. The role played by iodine deficiency in these changes is demonstrated by the fact that they are prevented by iodine supplementation of the mothers during pregnancy (Glinoer et al 1995) and that they do not occur in iodine replete areas in Europe such as some parts of The Netherlands (Berghout et al 1994).

In adolescents and children: Euthyroid pubertal goitre is especially frequent in adolescents and occasionally requires substitutive therapy by T_4 or iodide. Iodine metabolism is accelerated during this period of life.

A very important issue is that even today, clinically deficient regions of Europe exhibit subtle or even overt euthyroid schoolchildren born and raised in moderately neuro-psycho-intellectual deficits when compared to iodine-sufficient controls living an otherwise identical ethnic, demographic, nutritional and socio-economic population **(Table 3)**. These deficits (already listed in Section IV Table 4) are of the same nature, although less marked, than those found in schoolchildren in areas with severe iodine deficiency and endemic mental retardation (Delange 2001). As demonstrated in severe iodine deficiency, these deficits most probably result from transient thyroid failure occurring during foetal or early postnatal life, i.e. during the critical period of brain development (Delange et al 1993).

In neonates: The most important and frequent alterations of thyroid function due to iodine deficiency in Europe occur in neonates and young infants:

The frequency of transient primary hypothyroidism is almost 8 times higher in Europe than in North America (Delange 1997). This syndrome is characterised by postnatally acquired severe primary hypothyroidism lasting for a few weeks and requiring substitutive therapy (Delange et al 1983). The risk of transient hypothyroidism in the neonates increases with the degree of prematurity (Delange et al 1984). The specific role played by iodine deficiency in the aetiology of this type of hypothyroidism is demonstrated by the disappearance of neonatal transient thyroid failure in Belgian pre-terms since they were systematically supplemented with 30µg potassium iodide/day (Delange 1994).

8.1.4 Prevention and therapy of IDD in Europe

It is hard to accept that iodine deficiency, the most common preventable cause of mental deficiency in the world today (WHO/UNICEF/ ICCIDD 2001), is still so prevalent in Europe. The main cause of this dire state is the lack of awareness of the health authorities, doctors and the public at large.

The strategy for the elimination of iodine deficiency in Europe must start with information and health education through appropriate channels, not only of the public, but also of the health professionals. Consumption of seafood may be encouraged, but is of limited value.

The major measure for the prevention of IDD in Europe clearly is through Universal Salt Iodization (USI), i.e. the fortification of all salt for human and animal consumption and for the food industry. Possible side effects should be openly addressed, but without causing undue concern. Also, programs should clearly avoid the impression that they advocate a higher salt intake.

In 1992, iodized salt was available in most European countries, usually nation-wide, with the exception of Denmark where it was prohibited. It was compulsory in 8 countries, including Austria and voluntary in all the others, including Switzerland. The price was usually barely higher than non-iodized salt; it was even lower in France.

From 1992 onwards, and especially following the endorsement by WHO Euro of the recommendations resulting from the Brussels meeting that national iodine committees in all countries be appointed to promote the use of iodized salt, quite significant progress has been achieved in many European countries (Szybinski et al; 2001). National programs have been organised, which could result, as for example in Poland, in an exhaustive re-evaluation of the situation and in practical measures aiming at the implementation of USI.

The level of iodization of salt must be adapted at regular intervals to compensate for changing salt intake. For example, in Switzerland, because of the progressive decline in salt intake, the iodine intake slightly decreased in the seventies. In 1980, the level of salt iodization was therefore increased from 7.5 to 15ppm. This resulted in an increase of iodine intake from a borderline value of 90µg/day to a perfectly adequate value of 150µg/day. Rather unexpectedly, this change was not accompanied by any significant increase in the incidence of iodine-induced hyperthyroidism but rather, by a steady decline in the incidence of both toxic nodular goitre and Graves' disease (Burgi et al 1998). European countries which are actually in a state of moderate iodine deficiency thus may expect to make the transition to iodine sufficiency not only with no ill effects, but with the unexpected large benefit of a marked decrease of the incidence of hyperthyroidism in the elderly in addition to the disappearance of euthyroid goitre. Incidentally, the salt iodine content in Switzerland had again to be increased in 1998, again with full normalisation of urinary iodine excretion (Burgi et al 1998).

In their report published in 1999, WHO/UNICEF/ICCIDD indicated that iodized salt was now available in all 18 iodine deficient countries in Europe and that legislation on iodized salt were available in 12 of them.

Table 3 summarises the latest information we have available on the use and legal status of iodized salt in Western and Central European countries. Most countries have created a legal basis or even established a monitoring and/or promotional program. In 10 countries the sale of iodized salt is compulsory, in 17 it is voluntary, and in 3 the status of enforcement is unknown. 15 countries require iodide, 5 countries iodate, and 10 countries allow both iodide and iodate. The level of salt iodization ranges from 5 to 85ppm. The figures for the market share of iodized household salt must be considered with great caution, since salt producers

Table 3. *Regulations governing iodized salt in Western and Central Europe and market shares of iodized household salt*

	Latest review date	Legal Status	Compound (iodate or iodine)	Iodine amount (ppm)	Market share of household salt (%)
Albania	1999		(iodide)	(25)	
Austria	1999	C	both	15-20	95
Belgium	1992	V	both	6-45	(10)
Bosnia	1998		I(odide)	(20-30)	(50)
Bulgaria	1997	C	iodate	22-58	
Croatia	1999	C	iodide	25	53
Czech Rep	1999	C	Both	20 – 34	
Denmark	1999	V	iodide	8-12	
Finland	1998	V	iodide	25	>90
France	1997	V	iodide	10-15	55
Germany	2001	V	iodate	15- 20	(74)
Greece	2000	V	iodide	40-60	18
Hungary	1999	C	both	10- 20	
Ireland	1992	V	iodide	25	
Italy	1997	V	both	24 - 42	3
Luxembourg	2000	No law	both	10 -25	
Macedonia	2000	C	iodate	20 - 30	
Netherlands	1999	V	both	30-40 househ 70-85 bakers	(60)
Norway	1992	V	iodide	5	
Poland	1999	C	iodide	20 - 40	(90)
Portugal	1996	V	iodate	25-35	1
Romania	1999		iodate	40-50	25
Slovakia	1999	V	iodide	15 - 35	85 (imports; 70)
Slovenia	1998	C	iodide	5 - 15	
Spain	2000	V	both	51 - 69	(16)
Sweden	1999	V	iodide	40-70	
Switzerland	2002	V	both	20-30	94
Turkey	1999	V	both	25 - 70	20- 30
United Kingdom	1992	V	Iodide	10 - 22	2
Yugoslavia (Serbian Rep)	2000	C	Iodide	20	

V: voluntary.
C: compulsory.
Information in brackets is tentative.
Void cases: no information available.
Data from IDD Newsletters 1998- 2002; from Arbeitskreis Jodmangel and from personal communications.

unwillingly divulge sales figures, and regular household surveys are tedious to perform. Even when iodized salt is enforced by law, its market share may remain low, because of instability of iodine, non-compliance of producers or (cheaper) contraband imports. Market shares for the salt for food industry are even more difficult to estimate. We have therefore not included them in **Table 3.**

The staggering diversity of legal arrangements shown in **Table 3** results from several factors:

- Enforced use of iodized salt facilitates the management of a program, but in many countries it is unacceptable on constitutional grounds.
- Even though iodate is preferable because of its greater stability, many countries have had no problem with iodide and prefer it, because it is cheaper, and because the long-term safety of iodate is not established according to actual standards.
- Iodine intake may vary from one country to another, depending on dietary habits. In highly industrialised countries the share of household salt is smaller, because most salt comes from pre- processed food bought in the supermarket.
- It is clearly preferable to have all salt for human consumption (i.e. household and food industry) iodized, but some countries find it difficult to enforce iodized salt on the food industry.

Clearly then, international legislation would be of great help. The European Union has issued for consultation the draft Guideline on the Harmonisation of Legal Requirements in the Member States on Nutritional Supplements (KOM 2001 159 final 2000/080 COD). This guideline would allow direct supplementation (i.e. not via salt) of food with iodine. This would not allow the judicious dosing and necessary control of iodine supplementation that iodized salt affords. If enacted, this guideline would be a disaster for iodized salt programs.

The FAO/WHO Food Standards Program and the Codex Alimentarius Commission have established standards for food grade salt. These standards allow the addition of iodate or iodide, but leave the amount to be added up to the discretion of national health authorities. Thus the Codex standard will not eliminate the diversity, which will therefore remain an appreciable handicap for salt producers.

As long as USI is not systematically implemented in Europe, special attention has to be devoted to the protection of the two main target groups, i.e. pregnant and nursing mothers and young infants. If iodine deficient, these age groups should be supplemented with physiological quantities of iodine, for example by adding iodine to the polyvitamins administered to these two age groups. Moreover, the iodine content of formula milk should be increased in Europe above the classical recommendation of 5µg/dL. The present recommendations, endorsed by WHO Euro and by ICCIDD, are 10µg/dL milk for fullterms and 20µg/dL for preterms (Delange et al 1993).

In addition, in some European areas affected in the past by overt endemic cretinism, the iodine deficiency was and remains severe, for example in parts of Turkey (Erdogan et al 2001) and Romania (unpublished), with impairment of neonatal thyroid function and, consequently, with potentially harmful consequences for brain development. In such situations, emergency and transient more rapid measures can be justified from a public health point of view, such as the oral administration of iodized oil.

It is now demonstrated that in many industrialised countries such as the United States, Great Britain and Northern European countries, the main source of dietary iodine is neither salt nor seafood but dairy milk. This results either from the use of iodophors in the industrial processing of milk or from iodine supplemented diets for the animals, or from both. European rules for monitoring the iodine content of milk and a precise evaluation of the possible role of milk as a substrate for iodine supplementation in Europe are desirable (Phillips 1997).

Iodinated water has proved to be efficient in the control of iodine deficiency in developing countries, in situations where the access to water is well localised, for example by wells, and where most of the water is used for human and animal consumption. These conditions are probably rarely met in European countries.

Finally, it is conceivable that in exceptional circumstances where iodide or iodate are not accepted as sources of iodine for salt iodization for personal reasons, the use of natural seaweed as a source of iodine could be considered.

In summary, iodine deficiency still affected some 150 million people in Europe in 1992 and 97 million had a goitre. Substantial but insufficient progress has been achieved during the last few years.

More precise evaluation of some national situations, dissemination of the information, health education, universal salt iodization and adequate monitoring are the priorities in order to reach the goal of elimination of IDD in Europe.

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8.2

Iodine Deficiency Disorders (IDD) in Eastern Europe and Central Asia

Gregory Gerasimov

8.2.1 Summary and lessons learnt

During 1955-1970 iodine deficiency in the former Soviet Union was virtually eliminated (as evidenced by significant reduction of EG prevalence and elimination of most severe manifestations of IDD). This was accomplished by a mix of measures including significant production of iodized salt (up to 1 million tones annually), iodine tablets distributed in specific target populations, principally women and children in critical areas; and careful monitoring.

The main shortcoming of IDD/EG control in the USSR was its limitation only to "endemic goitre" areas. There was no legislation for universal salt iodization and IDD prevention was regulated by administrative mechanisms of the fully centralized economy. Iodized salt was supplied mainly to endemic goitre areas as identified on the list provided by the Ministry of Health. However, iodization of all edible salt was not mandated for the salt industry. In 1970s-1980s iodine deficiency gradually returned when supervision waned, and when regular effective monitoring reduced. Because of broader economic and political problems, the system of IDD/EG control started deteriorating and finally collapsed with the break up of the country in 1991.

After dissolution of the Soviet Union each newly independent state had to create its own system of IDD control and prevention. Results of extensive epidemiological studies carried out in all post-Soviet states in 1991-2002 revealed that the population is exposed to different degrees of iodine deficiency. Most severe IDD were found in Central Asian Republics, Kazakhstan and some regions of Russia. These surveys provided a solid background for high level advocacy, with international and bilateral organizations and donors aimed to initiate programs for IDD elimination in the region. Due to severe economic and political problems after the break up of the Soviet Union, major activities aimed at IDD control and elimination in the Newly Independent States started only in 1995-1997, much later than in other regions of the world.

The monitoring system for iodized salt (production and quality control) has been introduced over the past 5 years in all countries of the Region. Biological monitoring system is gradually strengthening with a network of urinary iodine laboratories established in most of the countries in the Region. Recent surveys showed that with introduction of iodized salt iodine deficiency in some countries has been eliminated or reduced.

Introduction of USI requires revision of existing legislation and strengthening of its enforcement. Laws or Presidential Decrees requiring USI and prohibiting production, import and trade of non-iodized salt for human and animal consumption were adopted only in 5 countries of the region. In other countries policies of IDD prevention are currently stipulated by the government (or health ministries) by resolutions that set a voluntary model of IDD prophylaxis. In the absence of mandatory legislation, the supply of iodized salt to households and food industry depends on demand by the retail traders, and hence, large and small consumers. A comprehensive legislative framework with a strong enforcement system is needed that requires mandatory iodization of all food-grade salt (table salt and salt for food processing).

Thus, compared to 1997, the countries of the region have made substantial progress in evaluation of IDD status and in expanded production, supply and use of iodized salt. In **fig. 1** the countries of the region are grouped according to the stages they had reached in relation to the "wheel' model". Some countries (Armenia, Turkmenistan) are very close to virtual elimination of iodine deficiency. However, the goal of IDD elimination has not been reached and additional efforts are needed to combat iodine deficiency in the region.

8.2.2 Introduction

This chapter provides information on the IDD status, control programs and salt iodization in 15 countries of Eastern Europe and Central Asia. Full details are available from ICCIDD's CIDDS database and in the IDD Newsletter Vol 18 No 3, August 2002.

Since endemic goitre (EG) in the Soviet Union had been considered to be under control, or eliminated, until recent time IDD attracted little attention from medical doctors and scientists. In 1986, the European Thyroid Association Committee on IDD failed to receive any information on IDD in the USSR (Gutekunst and Scriba 1988).

In November 1991 an International Symposium "Elimination of IDD", with special reference to the USSR, was held in Tashkent, Uzbekistan, sponsored by UNICEF, WHO and ICCIDD. Many Soviet colleagues presented data from their own republics and areas, information that was previously not available to the international world. The Proceedings of the meeting were published in Russian and in English and the main presentations were summarized in IDD Newsletter (1992, vol. 8, No.1).

In September 1997 the three international agencies charged with leading the fight against IDD (WHO, UNICEF and ICCIDD) organised a Regional Conference "Elimination of Iodine Deficiency Disorders (IDD) in Central and Eastern Europe, the Commonwealth of Independent States and the Baltic States" in Munich, Germany. The Conference was

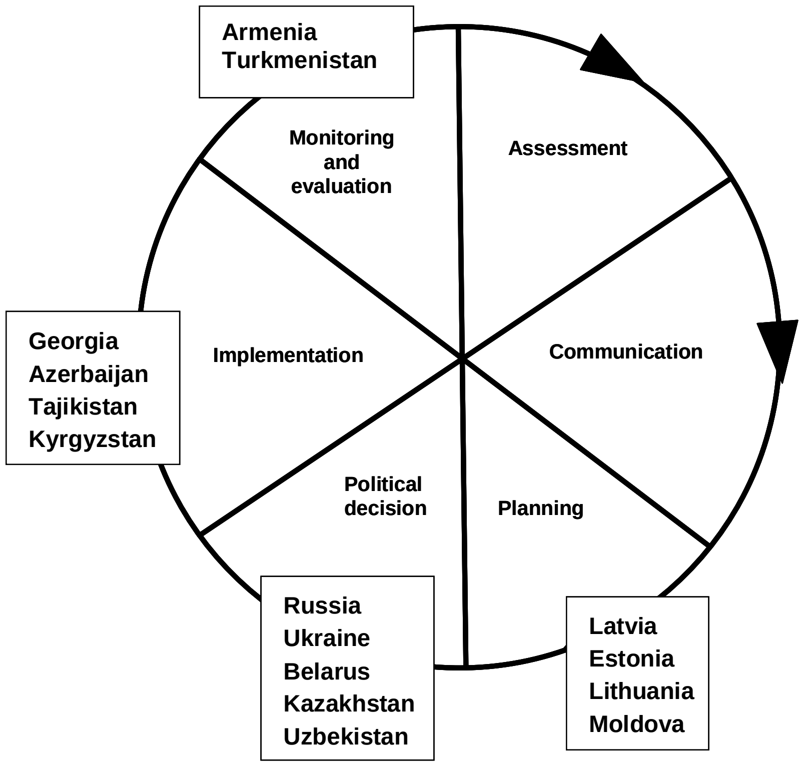

Fig 1. *Groups of countries according to the stages they had reached in relation to the "Wheel' Model" showing major components of national IDD elimination program (Hetzel BS, 1989)*

successful in identifying the extent of iodine deficiency, and the status of salt iodization measures taken in each country. An Overview of IDD and control programs in the Region provided updated information on the subject (Gerasimov and Delange 1997).

8.2.3 IDD Assessment and Surveillance

In the past 5 years (1997-2002) significant information has been collected on the extent of iodine deficiency in countries of the region. National and sub-national IDD surveys were conducted in Armenia (Branca et al 1998), Azerbaijan (Markou et al 2001), Belarus (Arinchin et al 2000) and Uzbekistan (Ismailov 2001). In Armenia, a national IDD survey has shown adequate iodine nutrition in the population and an effective program of USI that is controlling iodine deficiency (Branca et al 1998).

Development of an IDD control program in Latvia was constrained by the results of the 1995 IDD survey, reporting an almost normal median urinary iodine level, 98µg/L. A small-scale survey (in the year 2000) of about 600 children in 20 schools from all districts of the country clarified the current status of iodine nutrition in Latvia, showing generally mild iodine deficiency (median urinary iodine level 50µg/l). These results helped advocacy for a national IDD control program with USI in Latvia that is in the process of development (Selga et al 2000).

Russia has never had a national IDD survey, but numerous regional IDD assessments covering central, northern and southern regions of European Russia, West and East Siberia and the Far East were conducted in 1998-2001 and showed that iodine deficiency persists in most of its administrative regions with the exception of the Korean minority group in the south of Sakhalin Island (Sviridenko 2001). An effective regional program of salt iodization and iodine supplementation for risk groups has improved the critical situation described in Tyva republic in 1997 (Osokina et al 1998).

Regional surveys in Kazakhstan, Kyrgyzstan and Turkmenistan show various degrees of iodine deficiency (WHO CAR News 2000). Ukraine performed a national baseline IDD in 2002 with the assistance of UNICEF and CDC. Surveys in the northern area (close to Chernobyl nuclear station) and western mountainous regions of Ukraine in 1992-1998 revealed significant iodine deficiency. A 2000 IDD survey found iodine deficiency also prevalent in eastern and southern regions that were previously considered free of IDD, and it is now accepted that iodine deficiency in Ukraine is nation wide, not merely regional (Kravchenko 2002).

No national IDD surveys have been conducted in Lithuania and Estonia over past 5 years. However, recent studies reported that 17.7% of all newborns in Estonia (Mikelsaar 1998) and 20% in Lithuania (Kucinskas) screened for neonatal hypothyroidism have TSH levels above 5 microunits/l, suggesting the persistence of mild iodine deficiency.

8.2.4 Iodized salt production, supply and consumption

Iodized salt is currently being produced in 9 out of 15 countries in the Region. Some countries (Estonia, Latvia, Lithuania, Moldova, Georgia and Kyrgyzstan) do not have their own salt industry and import iodized salt from neighbouring countries; some salt in these countries is also iodized locally.

Iodized salt production was extremely limited in almost all countries of the region until 1997 (Gerasimov and Delange 1997). Since then significant efforts by the salt industry, with international support, have made iodized salt available in all countries, and production is scaling up. All edible salt in Armenia and Turkmenistan is currently iodized. Marked increase of iodized salt production is reported from Belarus (45,000 tones in 2000), Ukraine (68,000 tones in 2001), Tajikistan (21,000 tones in 1999), Uzbekistan and Kazakhstan. All these countries had virtually no iodized salt production in 1997.

In 1997-2002 most countries in the region adopted harmonised levels of salt iodization (40 +/-15ppm) and shifted from potassium iodide to the more stable potassium iodate (Russia, Ukraine, Belarus, Kazakhstan, Armenia, Turkmenistan, Tajikistan and Azerbaijan). Local production of potassium iodate (and iodide) has been recovered in Russia, Turkmenistan and Ukraine. These countries can cover the requirements of the salt industry in the region in quality potassium iodate.

In 1997-2002, Russian salt producers have built up sufficient production capacities for iodized salt (up to 700,000 tones annually) and the supply of iodized salt to the Russian population increased from less than 20,000 tones in 1997 to nearly 140,000 in 2001. It is safe to state now that there are no longer any real obstacles in the Russian salt industry fully meeting the country's demand for iodized salt (Apanasenko et al 2002).

Overall production of iodized salt in Ukraine increased from 40,000 tones in 2000 to 68,000 in 2001; and is expected to reach 90,000 in 2002. The supply of iodized salt for the domestic market increased in 2002, covering up to 30% of the potential demand for iodized salt. The export of iodized salt from Ukraine to CIS countries grew from 17,752 tons in 2000 to 46,018 tons in 2001, a 259% increase (Ermakov and Galushko 2002).

In 1997 no information on households (HH) consumption of iodized salt in countries of the region was available, but the Multi-Indicator Cluster Surveys (MICS) and Demographic Health Surveys (DHS) conducted in 1998-2000 offered new data. In Armenia 84% of households consume quality-iodized salt, leading to adequate iodized supply for the population. Consumption in Turkmenistan is lower (75%), most likely from losses of iodine from salt after production. Increase of iodine level in salt from 23 to 40ppm (effective from January 1, 2003) will help to improve iodine nutrition in that country. In Azerbaijan iodized salt consumption jumped from almost zero in 1998 to 41% in 2000, but the proportion of households consuming iodized salt in other countries of the region is one of the lowest in the world, only 4.5% in Ukraine and 8% in Georgia. Information is lacking for Belarus and Russia.

8.2.5 Legislation

Laws requiring USI and prohibiting production, import and trade of non-iodized salt for human and animal consumption were adopted in Georgia (1997), Kyrgyzstan (2000), Azerbaijan (2001) and Tajikistan (2002). In Turkmenistan USI was introduced by Presidential Decree (1994). A Government decree in Belarus (2001) requires exclusive use of iodized salt for processed food, except sea fish, and for public catering. Other countries regulate salt iodization and IDD prevention by government resolutions (Russia, Ukraine, Moldova, Lithuania) and/or decrees of health ministries. For example, in Lithuania a government resolution exempts iodized salt from 18% Value Added Tax (VAT). Legislation on IDD prevention requiring USI is currently pending in Armenia, Russia, Ukraine, Belarus, Kazakhstan, and Uzbekistan.

The Prime Ministers of all (except Turkmenistan) countries of the CIS in May 2001 signed an Agreement on IDD Prevention in the member states. In 1997-2001 CIS countries updated their salt standard based on Interstate CIS salt standard 13830-97.

8.2.6 Monitoring

Process monitoring (e.g. monitoring of iodized salt quality) has been re-instituted in all countries of the region once iodized salt appeared in the market. Several salt producers (in Russia and Belarus) introduced strict quality assurance of their products and were certified by the ISO. Many countries have introduced biological monitoring of the impact of salt iodization, and 11 of the 125 established urinary iodine laboratories, some of which serve regional as well as domestic needs and are participating in international quality control network.

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