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SYMPOSIUM: THYROID IN THE FACE OF CHANGING IODINE INTAKE

WORLDWIDE CHANGES IN IODINE INTAKE

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As we all know, until the early 90s goiter was synonymous of iodine deficiency. Most countries around the world investigated its prevalence and in 1960 the WHO published a map, showing the worldwide nature of the problem, as well as the relationship between iodine deficiency and certain geographic areas, as a permanent natural phenomenon.

Then, many countries all over the world started to implement iodized salt consumption programs aimed mainly at curing goiter. Unfortunately, with very few exceptions, such as Switzerland, most programs that were implemented were only temporarily successful and after initial enthusiasm, interest waned, monitoring lapsed, and the iodine content in salt was either absent or greatly diminished. Moreover, the importance of iodine deficiency and its correction was not adequately understood.

Universal and serious concern over iodine deficiency as a public health problem, and the commitment to eliminating it, only came about some years later after we and other investigators demonstrated that inadequate maternal iodine nutrition is a risky situation for mental impairment and brain damage of the developing fetus.

The foundation of the ICCIDD in 1985 was the result of the scientific commitment to this effort. As a matter of fact, one of ICCIDD's first commitments was to leverage scientific knowledge to better understand and redefine these disorders, including the newly identified spectrum of cognitive impairments. Nowadays, global education and advocacy programs have changed the ethos of iodine nutrition from one focused on treating affected individuals to one that emphasizes prevention on a national scale.

Some of the major milestones in the elimination of iodine deficiency are shown here:

1985 Foundation of the International Council for the Control of iodine Deficiency Disorders (ICCIDD)

1990 UN World Summit for Children. Declaration of the goal of virtual elimination of IDD

1994 WHO-UNICEF Joint Committee on Health Policy. Endorsement of Universal Salt Iodization as a save, cost-effective, and sustainable strategy to ensure sufficient iodine intake by all individuals

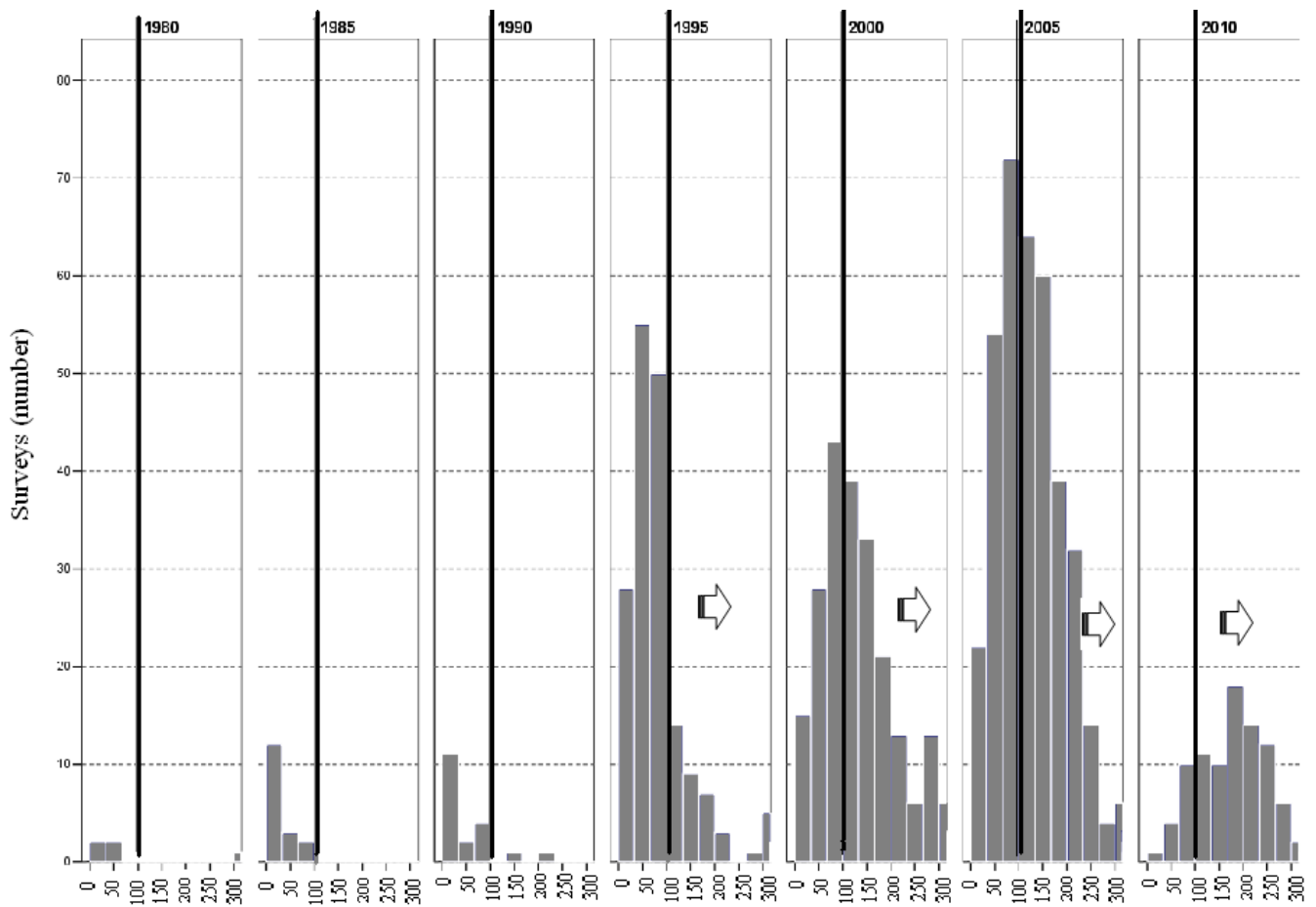
2005 World Health Assembly Resolution N° WHA 58.24. WHO Member States should report on the global situation of iodine deficiency every three years

As published by the WHO, during the last two decades following the declaration at the World Summit for Children, tremendous progress has been made in the sustained elimination of IDD.

My aim of my speech today is to review the changes in iodine intake that have taken place, mainly as a result of implementing the universal salt strategy in most of the world. I have used the median urinary iodine concentrations where available and representative as a measure of the changes.

As shown below (Fig. 1), the use of the median UI as an indication of actual iodine intake has progressively increased during the last ten years. It must the distribution increasingly skews towards the right, indicating higher amounts of iodine consumption.

Fig.1. Evolution of the use of the median UI as indicator of iodine intake



The information collected for this presentation came from many sources including the WHO database with data updated through 2006, a survey carried out among country health officials, data published in standard literature, including the IDD Newsletter, reports by consultants, ICCIDD regional coordinators, government papers, and the like. Although I recognize many limitations with this compilation, including incomplete or absence of data for many countries, the results of this data analysis offer the best assessment of the current international effort.

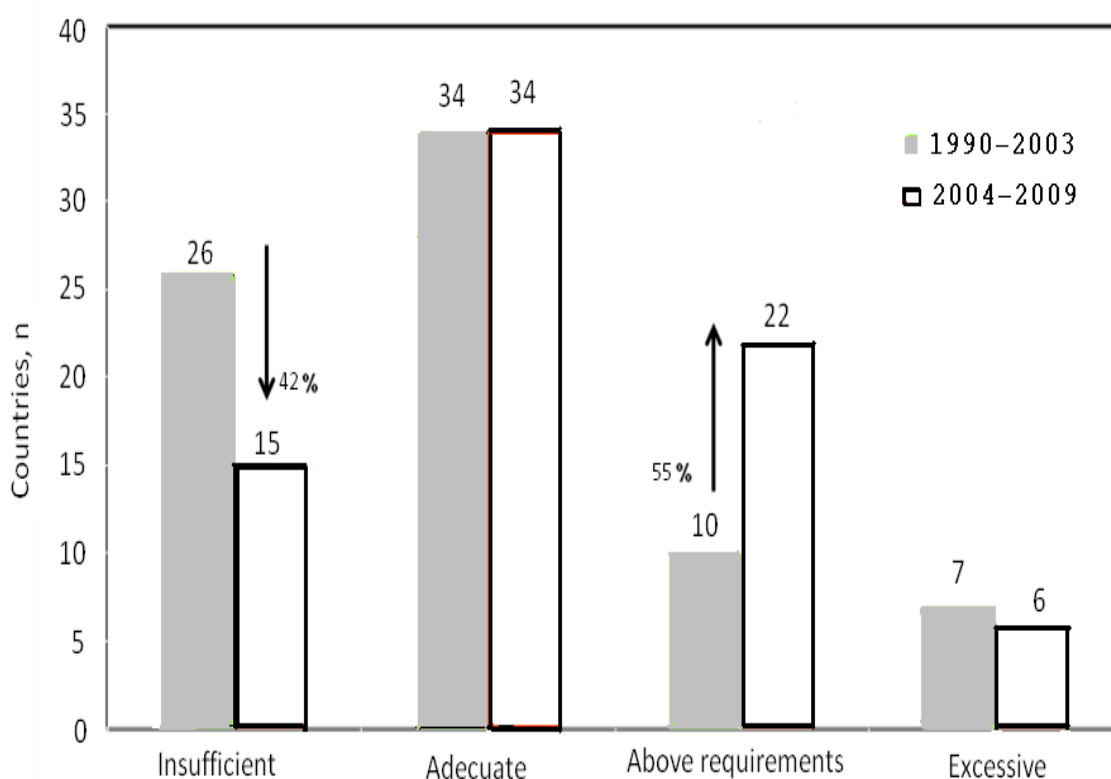
We have collected information from 148 countries (Table 1). Out of these, 77 countries have follow up data that allows us to compare the changes occurred between the 1990-2003 period and the last five year 2003-2009 period. The less follow up information came from the African and the Western European countries.

Table 1. Balance of countries reporting follow up evaluation of iodine nutrition status

CONTINENT	1990-2003 n	2004-2009 n	FOLLOW UP %
Africa	43	16	37
America	24	16	67
Asia	23	19	83
Europe	42	20	48
Middle East	12	6	50
Oceania	4	3	75
TOTAL	148	80	54

This comparative analysis very clearly shows that the changes in iodine intake between these two periods has resulted in a dramatic 42% fall in the number of countries with iodine deficiency. But, interestingly, it also shows an increase of 55% in the number of countries classified by the WHO as going beyond the intake requirements (Fig. 2). In my opinion, this change from insufficient to above required iodine intake could be considered beneficial rather than risky, taking into consideration the higher requirements of iodine intake for pregnant and lactating women. Further analysis and a review of the WHO's classification is needed.

Fig. 2. Changes of iodine intake based on median UI ($\mu\text{g/l}$): Impact on iodine nutrition status (77 countries)



As shown below (Table 2), the fall in the number of countries with iodine deficiency has mainly taken place in the Americas, Asia, Eastern Europe and Middle East. This change represents a benefit for about one billion people who are no longer iodine deficient.

Table 2. Change in countries with insufficient iodine intake

CONTINENT	Total countries n	Insufficient countries		Population 2007 millions	Insufficient population		Change in population with insufficient intake millions
		1990-003 n	2004-2009 n		1990-2003 %	2004-2009 %	
AFRICA	15	3	4	337	14.9	17.8	10
AMERICAS	16	3	1	475	5.4	1.5	-19
ASIA	18	7	3	2,884	37.3	4.6	-943
WEST AND CENTRAL EUROPE	13	4	3	220	44.2	47.4	7
EASTERN EUROPE	6	5	1	230	98.5	66.0	-75
MIDDLE EAST	6	2	0	87	18.6	0.0	-16
OCEANIA	3	2	3	25	84.1	100.0	4
TOTAL	77	26	15	4,258	35.6	11.3	-1,032
Estimated figures for the global population of 163 countries with iodine deficient							
TOTAL	163	52	42	5,657	31.0	12.9	-1,022

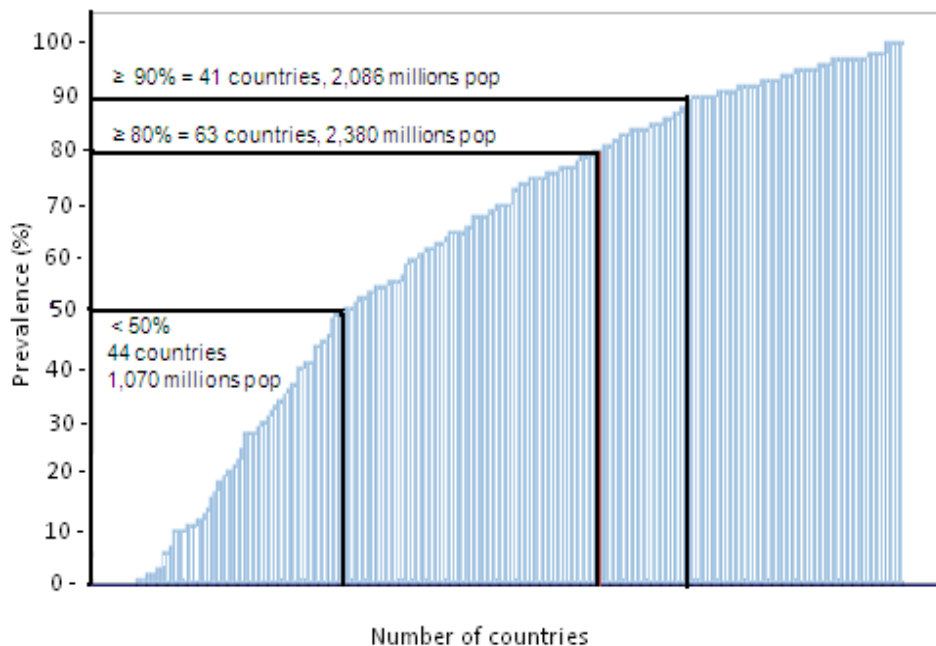
On the other hand (Table 3), the increase in iodine intake and, consequently, the higher proportion of median urinary iodine values observed in the period 2004-2009, took place in almost all regions, although more markedly in Africa, The Americas and Asia. Whether this phenomenon represents a risk of excess iodine for the general population or not requires further investigation.

Table 3. Increase in iodine intake from 1990-2003 to 2004-2009 periods

CONTINENT	Total countries n	Countries above intake requirements		Total pop 2007 mill	Population above intake requirements		Change in pop above intake requirements mill
		1990-003 n	2004-2009 n		1990-003 %	2004-2009 %	
AFRICA	15	1	6	337	2.9	24.5	73
AMERICAS	16	5	5	475	7.5	88.5	385
ASIA	18	3	9	2,884	46.8	50.4	106
WEST AND CENTRAL EUROPE	13	0	7	220	0.0	7.9	17
EASTERN EUROPE	6	0	2	230	0.0	2.4	5
MIDDLE EAST	6	0	5	87	0.0	4.5	4
OCEANIA	3	1	0	25	15.9	0.0	-4
TOTAL	77	10	34	4,258	32.8	46.6	586
Estimated figures for the global population of 163 countries with above requirements							
TOTAL	163	18	31	5,657	28.6	41.6	738

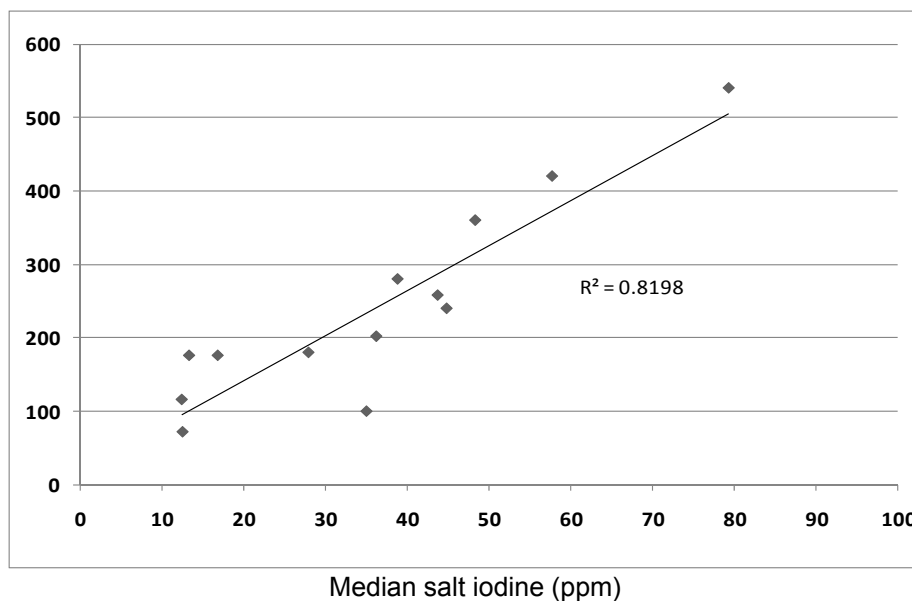
The great progress in the fight against iodine deficiency during the last two decades has primarily been the results of an aggressive push for iodized salt use. As published by UNICEF, while 1990 only 17% of households were consuming iodized salt, by 2006 the proportion was increased to about 73% worldwide. It must be noted, however, that despite the great progress, almost 30% of the world's population is still struggling with substandard iodine nutrition. One of the reasons for this situation is that neither the proportion of households consuming iodized salt nor the quality of the iodized salt is the same in all countries. As shown in Fig. 3, the analysis of the data collected shows that only in 41 countries are more than 90 percent of households actually consuming adequate amounts of iodized salt, as recommended by WHO.

Fig. 3 Distribution of countries according to percentage of households consuming iodized salt



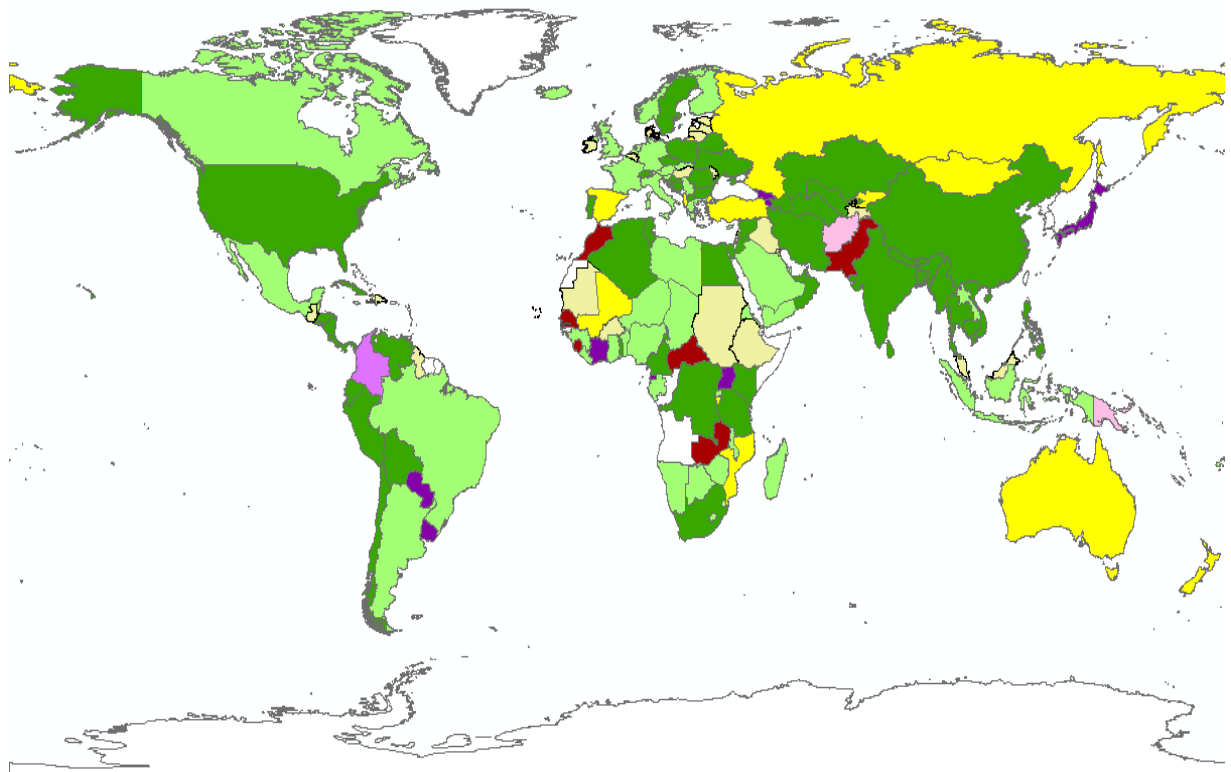
Another reason could be the wide range in the level of iodine added to the salt, which varies from 13 to 100 ppm. We have demonstrated a significant direct correlation between the median UI iodine value and the median salt iodine (Fig. 4).

Fig. 4 Relationship between the median urinary iodine and the median iodine content in salt



Using the updated data corresponding to the last 5 years, and making estimates based on data collected during the 1990-2003 period, the current estimated global distribution of iodine nutrition is displayed in Fig. 5. We have followed the classification recommended by ICCIDD/WHO/UNICEF, which classifies the iodine nutrition of countries into nine categories: (1) severe deficiency; (2) moderate deficiency; (3) mild deficiency; (4) likely deficiency; (5) sufficiency; (6) likely sufficiency; (7) excess; (8) likely excess; and (9) unknown.

Fig. 5. Global distribution of iodine intake (nutrition)
1990 - 2009



Although there is not sufficient data on iodine intake in pregnant women, a few available spot studies (Table 4) raise concerns because the majority of them are below the median urinary iodine range of 150 to 249 µg/L recommend by WHO-UNICEF-ICCIDD. These studies come mainly from countries which were previously iodine deficient but where the current urinary iodine in school age children is now normal, as well as from two industrialized countries, the United States and Italy. These findings clearly confirm that the adequate iodine nutrition status in school-age children does not necessarily reflect the situation in pregnant women. Consequently, there is a need for direct monitoring of pregnant and lactating women to ensure an adequate iodide intake and prevent the risk of the fetal brain damage caused by iodine deficiency.

Table 4. Recent evaluations of Iodine nutrition in pregnant women

Country	Urinary iodine, µg/L		Reference
	SAC	PW	
New Zealand	66	38	ThyroidMobil, 2005
Thailand	108	108	S Gowachirapant, 2009
Peru	180	115	EA Pretell and AM Higa 2005
Bangladesh	135	133	G Ara, 2010
Philippines	201	142	LA Perlas et al, 2006
China	246	<100-150	C Zupei, 2006
Bulgaria	182	158	L Ivanova, 2008
Cameroon	252	166	MM Gimou et al, 2007
Niger	270	167	D Lantum, 2003
Venezuela	206	174	LA Caballero, 2009
Macedonia	241	175	B Karanfil
Azerbaijan	204	200	I Akhmedow et al, 2008
Mexico	176	238	P García-Solis, 2009
USA	168	139	KL Caldwell et al, 2008
Italy	102	83	C Mian et al, 2009

Conclusions

- 1) Globally, most of the countries have made significant progress towards the elimination of IDD by increasing their iodine intake mainly through the consumption of adequately iodized salt. However, problems remain that threaten the effective and sustained elimination of IDD in the whole world.
- 2) The increase in iodine intake has also resulted in an increased number of countries with iodine intake above the WHO requirements. The implications of this situation need further evaluation.
- 3) Monitoring of iodine in salt and in people is essential to assess and maintain optimum iodine nutrition levels. It must be sustained and systematic, and results must be communicated to the appropriate levels of decision makers to take any necessary corrective action.
- 4) Compliance with the WHA Resolution, requesting that State Members report every three years on their iodine nutrition status is necessary to sustain and strengthen the political commitment towards the global goal of sustained iodine elimination of IDD.