

IDD NEWSLETTER

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IDD Day in Kenya

This event took place on October 27, 2001 in Mombasa, sponsored by the Ministry of Health, the Ministry of Education, the Kenya Salt Manufacturers Association (KESAMA), UNICEF, and members of the community. Mombasa is a major salt producing area for Kenya and East Africa, and the producers combined efforts to support IDD Day. The activities included a parade, skits, and informational talks. Testing for iodine content of salt with kits was demonstrated and taught by students and nurses from the local hospital. The provincial health chief and colleagues provided information. A parade with floats from the different manufacturers and other groups passed through the city's streets, tossing free packages of iodized salt to onlookers. T-shirts and caps were distributed. A well-known local band wrote and performed a song in Swahili that emphasized the benefits of iodized salt. The day was preceded by publicity in the media and news captions, and



COURTESY UNICEF/KENYA

School girls test for iodine content of salt with rapid test kit, IDD Day, Kenya.

was covered by national television. It spurred an increase in activities by industry, especially in advocacy. Similar events are planned for the future. ■

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IDD In Some Sub-Saharan Countries

Affluent countries and international agencies are now taking a more careful look at health in Africa, propelled in part by the staggering incidence of HIV infections and the inadequate treatment provided for it. Iodine deficiency has long been a chronic health issue for virtually every country on the continent. Several experimental studies suggest that iodine deficiency impairs the immune response and the ability to fight infection. The lowered capacity of the population and poverty brought on by iodine deficiency add further damage. The increasing attention to African health offers a challenge and an opportunity to move forward more aggressively to correct its iodine deficiency, which carries many other adverse effects in addition to those on fighting infectious diseases.

The present article updates information in several countries. Others will be summarized in future issues of the *Newsletter*.

KENYA

Goiter was endemic in parts of the country a generation ago. Surveys in 1962 showed prevalences of 72% in Kericho, 44% in Kiambu, 16% in Nairobi, and 18% in Mombasa. Voluntary salt iodization started in 1970 with legislation in 1978, and the level was increased to 100 ppm as iodine in 1990 (*IDD Newsletter* 13:21, 1997).

Iodine nutrition - A 1994 national micronutrient survey conducted in 45 districts found a total goiter rate of 16%; five districts had a prevalence greater than 30%. Earlier reports were of urinary iodine concentrations between 62 and 113 mcg/L. The 1995 multicenter study of three sites found median urinary iodine excretions, respectively of 125, 378, and 580 mcg/L. The country is planning a survey based on urinary iodines sometime in 2002, and bids have been solicited for it.

Iodized salt - Salt is iodized at a high level (100 ppm as iodine). There are very few small or local producers. Animal salt, generally processed separately with cattle licks and other minerals, is iodized and widely used, covering most cattle salt in both Kenya and Tanzania. Kenya supplies most of its own salt, about 90% of Uganda's, 90% of Rwanda's, 34% of Tanzania's, 70% of Burundi's, and some of southern Sudan's. The major production sites are Melinda, on the coast, and Mogadi, close to Nairobi. A rapid assessment in 32 districts in 2000 found wide variation both between and within brands, ranging from 21 to 180 ppm iodine in the salt. The Kenya Salt Manufacturers Association (KESAMA) was formed several years ago and is now officially registered in the country.

Program - The nutrition program in the Ministry of Health shares responsibility with the Kenya Bureau of Standards, which regulates iodized salt. A national committee, headed by the MOH, deals with iodine, iron, and vitamin A, and works with WHO, UNICEF, salt producers, and others. Recommendations by the MOH include more training for district mid-level health officers and the operational staff, IEC for iodized salt, monitoring of salt for iodine content, and utilization of the national laboratory for urinary iodines. UNICEF has actively assisted in consumer awareness, especially IEC materials, school activities, and informational commercials. UNICEF, KESAMA, and other partners promoted IDD Day on October 27 in Mombasa (see accompanying photos and skit summary).

BAD SALT, NO BABIES

Synopsis of a skit presented by participants in the Kenya IDD Day.

We are in a Kenyan village where miscarriage is common. Everyone is concerned. Husbands beat their wives, thinking they are bewitched, and blame them for the failed pregnancies. Then the public health officer appears, and considers the situation. He learns that the women in the village, on instructions from their husbands, are scraping the leavings from the local salt factory in an effort to cut down on expenses, and thus are not getting iodized salt. He tells them that this practice is the cause of their abortions. The husbands then realize they were wrong in telling their wives to collect the bad salt, and they promise from now on always to use iodized salt.

Comment - Kenya is a dominant iodized salt producer for the region. Major needs are better quality control with iodized salt, updated information on urinary iodine concentration, and participation in regional decisions about harmonization of salt iodine levels.

DEMOCRATIC REPUBLIC OF CONGO (Kinshasa)

Congo had some of the most severe IDD in the world. Extensive investigations by Belgian and Congolese scientists a generation ago defined its severity, the high incidence of cretinism, especially the myxedematous type, and the contributing role of thiocyanate ingestion (*IDD Newsletter* 13:23, 1997). Assessments in the early 1990's led to a Ministerial order for salt iodization and strict control on importation (essentially all of the country's salt is imported). Coverage of iodized salt has been better than 90%, and sporadic data have indicated major improvement in iodine nutrition.

In 2001, a careful national survey was carried out, led by Dr. T. Ntambwe-Kibambe, ICCIDD Subregional Coordinator for Congo and Francophone West Africa. The summary has been translated by Professor Daniel Lantum, ICCIDD Regional Coordinator for Africa, and the current article is abstracted from it.

The report summarizes the history of the program. Studies in the early 1990's showed a goiter prevalence of 42%, ranging from 9.6% in Bas-Congo to 66.4% in Oriental. A Ministerial order in 1993 regulated the production, quality control, and marketing of iodized salt for human and animal consumption. Implementation, begun in 1994, included an information campaign, blocking the import of non-iodized salt, laboratory instal-



COURTESY UNICEF/KENYA

IDD Day, Kenya. Top: Parade across city, in support of iodized salt. Above left: Beginning of parade. Above right: Schoolchildren listen to entertainment advocating iodized salt to eliminate IDD.

lation for testing salt, and monitoring through a system of inter-sectoral committees in sentinel health zones in each province. By 1997, iodized salt consumption was > 90% throughout the country. In 1998, an evaluation in north Kivu found that 99% of salt was iodized and the median urinary iodine excretion was 432 mcg/L.

The 2001 survey used the 30 cluster approach, with schoolchildren aged 6-12 years, and was originally projected for 10,755 subjects, in two to three health zones randomly selected from each of the 11 provinces. Civil unrest required modification of this plan, and data could be collected in only 18 health zones. A total of 6,035 children were examined. Of 5,774 salt samples they brought from home, 96.7% were iodized. The overall goiter prevalence was 5.7%, and the median urinary iodine concentration (of 1,101 samples) was 495 mcg/L (range 150-650 mcg/L); only 10% were below 100 mcg/L, and 66.2% were > 300 mcg/L. The authors note that the country is no longer

iodine deficient, but instead there is concern about iodine excess. They recommended regulations to lower the iodine content of salt at importation to 20-40 ppm. This revision is apparently in progress. They also recommend the availability of serum TSH as a monitoring indicator to recognize cases of hyperthyroidism, and urge due attention to measures for ensuring sustainability.

NIGER

Report at Niamey - Dr. Daouda Hamani prepared a report entitled "Evaluation of the effectiveness of iodized salt two years after universal consumption of iodized salt in Niger; a survey on schoolchildren in 1998." This was presented at the Niamey meeting on IDD in Francophone Africa in March, 2002, and translated into English by Professor Daniel Lantum, ICCIDD Regional Coordinator for Africa.

Monitoring is an essential element in maintaining progress.

Iodine nutrition - Previous surveys by Dr. Daouda included the first in 1994, of 8,933 pupils, aged 10-15, that reported a total goiter rate of 35.8%, and a median urinary iodine of 34 mcg/L in 795 students - 90% were < 100 mcg/L, 69% < 50 mcg/L, and 27% < 20 mcg/L. Two years after the effective introduction of iodized salt, a survey in 1998 assessed 944 students from 237 primary schools in eight divisions of the country. The total goiter rate had decreased from 36% to 20%, and visible goiter from 5.7% to 1.4%. The median urinary iodine was 270 mcg/L with the medians among the country's seven divisions ranging from 116 to 796 mcg/L. The urinary iodine: thiocyanate ratio was 27 mcg/mg, well above 7 mcg/mg, the value usually accepted as physiologically normal; previously it had been 3.4 mcg/mg.

Iodized salt - Almost all salt is imported from Ghana and Senegal. The 1998 study obtained 894 salt samples from retailers, and found 64% were > 25 ppm. In Dosso, Tahoua, Tillabery, and Niamey, 71% were adequately iodized, but in Agadez and Zinder, the percent was lower. In Agadez, much salt is produced locally, and in Zinder, noniodized salt comes from neighboring countries; also these populations have shown some reticence about using iodized salt.

Comments - The survey report made a number of recommendations:

for the program: proper priority and budget for the IDD program; an intersectoral IDD committee; improved policies and plans from the government; appropriate monitoring; vigorous public communication; priority research programs among the appropriate ministries, NGO's, and universities; and reporting at national hospitals for possible iodine-induced hyperthyroidism;

for quality control of salt: appropriate testing at customs posts with proper monitoring and coordination of quality of salt, provision of iodization equipment for local producers;

for surveys: inclusion of urinary iodine determination; repeat surveys every five years of iodized salt coverage and iodine content; national evaluation of urinary iodine every two years, at sentinel sites, with more frequent monitoring, to include periodic quality control of salt at the household levels with rapid kits, assessment of goiter prevalence, and urinary iodines. The report also recommended improved equipment for the IDD laboratory at the Faculty of Sciences of the Abdou Moumouni University, and appropriate training of technicians. Training for quality control of iodine in salt was recommended, as well as operational research on factors that cause loss of iodine in salt and on the influence of goitrogenic substances in the region.

To supporting organizations (ICCIDD/UNICEF/WHO): a workshop for presentation of surveys to the health authorities; training of workers on management, epidemiology, IEC, and laboratories; support for university teachers working in micronutrients to be active in international seminars; and study tours among countries of the Subregion to improve communication and exchange of experience within the area.

Additional comments - The ThyroMobil visited Niger in 2001. The data have not yet been analyzed, but a preliminary report shows a median urinary iodine of 54 mcg/L, in sharp

contrast of the 1998 data reported above. Possible causes for this change need prompt investigation.

GABON

The first national survey was carried out in June, 2001, with the active consultative participation of Dr. Theo Ntambwe-Kibambe (ICCIDD Subregional Coordinator for Francophone West Africa) and Professor Daniel Lantum (ICCIDD Regional Coordinator for Africa). The results were presented in a report, authored by Dr. Ntambwe-Kibambe, Professor Lantum, Dr. Ntyonga-Pono, Dr. Ngou-Milama, and Dr.

M. Epoulou. This article summarizes the results, from a translation by Professor Lantum.

Until quite recently, little was known about iodine nutrition in Gabon. In 1989, one of the authors, Dr. Marie Pierette Ntyonga-Pono reported in the southeast a goiter prevalence of 38% in schoolchildren and 34% in adults. In 1998, she retrospectively reviewed hospital cases reaching the University Hospital Center in Libreville and found goiters coming from many parts of the country, suggesting widespread iodine deficiency.

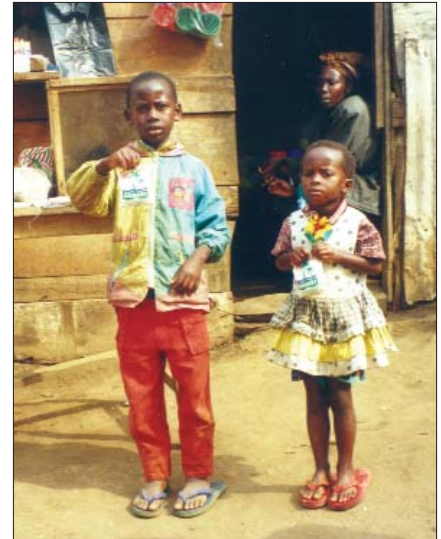
The 2001 study consisted of 30 clusters of schoolchildren, aged 6-12 years, distributed among the four main ecological zones of the country: littoral, savanna, mountain, and forest. The 3,280 subjects came from 50 schools, and ranged in number from 1,120 (littoral) to 480 (mountains). Every fifth child provided a urine sample and children also brought salt samples from homes for rapid testing. By palpation, the national goiter prevalence was 17.1% (littoral 4.1%, mountain 20%, forest 21.4%, savanna 31.7%). The province of Haut Ogooue had the highest goiter prevalence, 49.3%; next was Ogooue-Lolo, 28.3%. Most goiters were not visible. Several hyper-endemic divisions were found; the highest, Ogooue-Litili, had a prevalence of 71.7%.

The median urinary iodine for the whole country was 190 mcg/L, mean 273 mcg/L (306, range 0-2,478 mcg/L. Thirty percent of the samples were > 300 mcg/L. The median urinary thiocyanate level was 10.9 mg/L, ranging from 7.1 mg/L for the littoral zone to 30.3 mcg/L in the forest. The MBI rapid test kit survey found a national average of 36% containing iodine (the UNICEF database records 14.9% as of 2000).

In their discussion, the authors report that iodine deficiency is most severe in the interior. Iodized salt comes from some European sources but most from Cameroon and Senegal. They made the following recommendations: a plan of action, to eliminate IDD by 2005; creation of an IDD data bank in the Nutrition Service; national legislation to control production, importation, marketing and quality of salt for human and animal consumption; appropriate training for the nutrition team and salt dealers; adjustment of iodine levels in the salt to produce a urinary iodine content of 100-200 mcg/L, i.e., 20-40 ppm range with KIO₃; systemic monitoring of imported salt at the border; another survey on food habits to clarify consumption of goitrogenic foods; a campaign on proper food processing for cassava; and study of TSH in areas of high IDD endemicity. The results will be discussed at a national meeting in May, 2002, in Libreville and an action plan developed.

UGANDA

Iodine nutrition - Many early studies showed the presence of endemic goiter in Uganda, accompanied by stunting, under-



weight, protein energy malnutrition, vitamin A deficiency and cassava consumption. A 1991 survey in four endemic districts reported a total goiter rate of 75%. The MOH commissioned a survey, funded by UNICEF in April 2000, that found a total goiter rate of 60% among 2,875 children in six districts from different parts of the country; 40-50 urine samples taken from each of these districts (total 293 samples), had a median UI of 310 mcg/L (range 156-517) (this study used Method E, which omits digestion or urine; most analysts recommend that digestion be included). The high goiter rate (by palpation) and the high urinary iodine level, are consistent with recent correction of iodine deficiency, but the data need clarification. Scattered surveys from the early 1990's found goiter prevalences ranging from 15.7% to 75%.

Iodized salt - Most salt (about 90%) comes from Kenya, regulated by statute under the Food and Drugs Act and the Uganda Standards (Specification for Food Grade Salt, 1994). Salt imported in the country should contain 100 ppm as iodine, and should be 50 ppm at household level. A resolution of the Cabinet in 1993 included iodization of salt for livestock consumption as well. The 10% of the nation's salt produced in the country, by small operators mostly in Kasese, is the source of much of the country's cattle salt, and is also frequently used by people; it is currently not iodized. A 1997 survey of 165 salt samples from Kampala and from several outlying districts reported that 60% of samples contained at least 50 ppm iodine. A DHS survey has just been finished and the data should soon be available. Salt is also tested at the border using kits. The Bureau of Standards does spot checking and can also measure by titration. UNICEF is supplying kits, which are reportedly working well.

Program - An interagency nutrition committee meets every two months. It includes the salt retailers and is chaired by the Ministry of Health. The government and UNICEF have submitted a project request to provide effective salt iodization in Hoima and Lake Katwe in the west, technical training for the salt producers, increased IEC, monitoring and quality control at import, and establishment of a sentinel surveillance system, the latter measuring iodine in urine and salt.

Comments - Most of the salt comes from Kenya, where the iodine level is quite high (100 ppm). This is compatible with the reported high urinary iodines, although the methodology of the latter needs review. Kenya, Tanzania, and Uganda have economic agreements (CONSELO) and all have salt iodized at 100



COURTESY JOHN T. DUNN

Top left: Local production of salt, western Uganda. Top right: Children in a rural Ugandan market holding packets of iodized salt. Above: Workers harvesting salt at local pond, western Uganda.

ppm iodine. If the reported median urinary iodine level is correct and if the iodine content of salt at consumer level is high, the iodization level at production should be lowered, probably to the range of 30-50 ppm as iodine. This re-emphasizes the need for a harmonization of salt iodization levels for eastern and southern Africa.

TOGO

A 1986 survey identified the northern (Kara), central, and plateau regions as having the highest goiter rates of five regions surveyed. In 1992 another survey of 984 schoolchildren around Kara found a total goiter rate of 32%, a urinary iodine excretion of 7-34 mcg/g creatinine, and increased urinary thiocyanate.

The ThyroMobil visited ten sites in 2000, finding a goiter prevalence of 4.3% by ultrasound (but this may be an underestimate because the older normative criteria were applied), and a median urinary iodine, of 116 mcg/L from 381 samples. Five sites had a median < 100 mcg/L, and 13% of samples were >

Harmonization among countries of iodine levels in salt is a major priority for Africa.

300 mcg/L. The median salt iodine concentration was 39 ppm (*IDD Newsletter* 17(2):26, 2001).

As a result of the ThyroMobil study, the Ministry of Public Health conducted another survey with an expanded sample base to include more remote communities. The data were reported in December 2001. Dr. Daniel Lantum, ICCIDD Regional Coordinator for Africa, has provided an English translation, from which this summary is abstracted.

The country was divided, on the basis of a 1989 study, into three endemic zones: (1) - severe; (2) - pockets of severe endemicity; and (3) - mild endemicity. Subjects were school children 5-12 years old within normal ranges of weight and height for age. The protocol included random sampling of clusters of pupils in selected schools in the three zones, and of additional schools and zones to assure wider representation of all groups. The final group examined was 6,210 students, 57% males, in 125 schools. The goiter prevalence by palpation overall was 7.2%: 16.1% in zone 1, 10.1% in zone 2, and 0.8% in zone 3. The overall figure was a decrease from a 1989 survey showing 18.4%.

The median urinary iodine concentration was 160 mcg/L: zone 1, 170; zone 2, 130; and zone 3, 170 mcg/L. The sample size was 1,245, and the range was 2-6,150 mcg/L. Thirty-five percent were < 100 mcg/L, 29% above, and the remaining 36% between 100-300 mcg/L. There was a slight shift geographically from lower to higher values from the savanna region to the maritime. Medians for different regions were: savanna, 115 mcg/L; Kara, 155 mcg/L; central, 250 mcg/L; plateau, 169 mcg/L; and maritime, 155 mcg/L.

A total of 315 salt samples were collected, tested both with the MBI rapid kit (in gradations of 0, 25, 50, 75, and 100 ppm), and quantitatively by titration. Overall, 75% of households were consuming adequately iodized salt: 17%, 1-24 ppm; 19%,

25-49 ppm; 37%, 50-74%; and 1.6%, 75-100 ppm. The fraction < 25 ppm was 21% (zone 1), 48% (zone 2), and 50% (zone 3). Iodized salt was available in all the zones, but sometimes noniodized salt entered the market or declined in quality. By region, up to 43% of salt in the savanna region had no iodine, and up to 35% in the maritime region. Household samples measured by titration showed that 98% had some iodine. Overall, 35% were < 15 ppm, 37% were 15-49 ppm, 23% were 50-100 ppm, and 3.5% were > 100 ppm. These figures varied regionally, with < 15 ppm in 53% of samples from the savanna, 15% from Kara.

In the discussion, the authors note differences between the rapid test kits and titration, and emphasized the titration figure, giving 98% total coverage, as the more reliable. Togo's neighbor, Ghana, is the major salt producer in the subregion, and the recent intervention of Unilever Ghana in 2000 to purchase and iodize all salt from small producers in southern Ghana may be having an effect. The savanna region currently has the lowest iodine nutrition and the lowest penetration of iodized salt. This may stem from the great distance from the source of supply, from infiltration of poor quality salt, from long storage, or from poor handling in the remote and rural zone. This region needs special attention to salt quality control practice.

The authors note that the data on iodized salt use and urinary iodine excretion show that Togo is well on its way to IDD elimination. They recommend: (1) more quality control of salt, especially for the three northern regions; (2) heightened political support and increased awareness to motivate sustainability of the program; (3) appropriate food, nutrition, and education, especially for the northern regions, where some goitrogens may be involved; (4) strengthening of the program to ensure better follow-up of activities, especially salt quality control; (5) a complementary study to investigate a relationship between goiter and food habits; (6) establishment of an iodization unit at the salt entry point, especially in the district of Cinkasse in the division of Bassar in the Kara region; and (7) consideration of one round of iodized oil in the three regions of savanna, Kara, and plateau, if after one year of improved salt quality control, the endemia persists. ■

VISIT ICCIDD ON THE INTERNET

ICCIDD Homepage: <http://www.iccidd.org>

Contains information on IDD and ICCIDD (including names and addresses of Board), the country-specific database (CIDDS), and technical database (IDDTECH) (including texts of IDD Newsletter from 1992 to present).

ICCIDD Communication Focal Point <http://www.tulane.edu/~icec/iddcomm.htm>

Contains information on IDD communication.

The WYD Iodine Checker: A Simplified Approach to Measuring Iodine in Salt

BY THE SALT RESEARCH INSTITUTE, CHINA NATIONAL SALT INDUSTRY CORPORATION, TIANJIN, P.R. CHINA

Adding iodine to salt is the easiest, most economical and most effective way to eliminate IDD. However, measuring the iodine content in iodized salt quickly and precisely during its production and distribution can be difficult. The traditional titration method measures the iodine content accurately but is not easily applied in salt plants. Test kits are quick, but the results are not quantitative. To solve these problems, the Salt Research Institute of the China National Salt Industry Corporation developed the WYD Iodine Checker, which can be conveniently used at sites of salt production and distribution, allowing the iodine content to be measured easily and accurately.

The WYD Iodine Checker is a single wavelength filter photometer with the functions of LCD readout, zero auto calibration and concentration readout (see photo). Its small bulk, reliable performance, and accuracy make it user-friendly.

The WYD Iodine Checker is based on the "luminosity" principle. A fixed amount of iodized salt is dissolved in distilled water, then H_2SO_4 (sulfuric acid) and KI (potassium iodide) are added. The iodine reacts with starch to produce a blue color, and the degree of color as measured by the Iodine Checker is proportional to the content of iodine.

The following are its specifications:

- Stability - drift less than 0.3 mg/kg in 10 minutes;
- Measurement range - from 10-80 mg/kg;
- Readout - 0.1 mg/kg
- Accuracy - analytical error < 2 mg/kg;
- Precision - fluctuation < 2% at 50 mg/kg;
- Bulk - 175 x 135 x 60 mm;
- Weight - 500 g;
- Power requirement - AC 220v or DC 9v

The Checker is operated as follows: one gram of iodized salt is placed in a 50 ml tube; 10 ml of distilled water, 2 ml of solution A (H_2SO_4 - Vitriol), and 2 ml of solution B (KI) are added, and then diluted to 50 ml with water. The tube is shaken until the salt is dissolved thoroughly, then the cell that contains this solution is inserted into the cell holder of the Checker, and the iodine concentration is directly read on LCD. Calibration is against water, a standard test solution, or a gray glass accessory to the instrument.

On independent testing, the Department of Chemical Engineering and Applied Chemistry of Toronto University found that results from the WYD Iodine Checker agreed very well with those from the conventional titration method, demonstrating good accuracy, precision, and reproducibility.

In 2000, UNICEF and the Ministry of Health of China requested the China National IDD Reference Laboratory to evaluate the WYD Iodine Checker. Over 11 months, the Reference Laboratory compared the titration method with the Checker. In addition to this, they assessed the Checker in 100 iodine labs in the health sector for three weeks and surveyed its performance in 100 labs in salt plants. The evaluation showed the following:



The WYD Iodine Checker.

Simple methods for measuring iodine in salt can greatly help quality control.

- a. The precision of this method is a little bit lower than that of titration. The variance coefficient in a batch is no more than 5%. It is qualified for practical use.
- b. The results were always accurate when using standard material to do recovery experiments.
- c. The survey among end-users indicated that 80% found results from the Checker to be accurate, stable, and reproducible, and the instrument easy to use and carry, and they were willing to become permanent users.

The Salt Research Institute is approved by the China National Administration of Technology Supervision and licensed to manufacture WYD Iodine Checkers. So far, more than 1200 Iodine Checkers have been sold to iodized salt plants, iodized salt distributors and public health labs in 30 provinces and municipalities in China. Additionally, more than 30 sets have been exported to Vietnam, Burma, Nepal, Bangladesh, Korea, Greece and other countries.

The Salt Research Institute welcome others in the world salt industry to use the WYD Iodine Checker. For further information contact:

The Salt Research Institute, CNSIC, 831 Yingkou Road, Tanggu, Tianjin, P.R. China, telephone/fax: 86-22-25897596, E-Mail: Sri88@tjlink.tisti.ac.cn or Sri831@starinfo.net.cn. ■

Long-Term Stability of Iodized Salt: The Multiple Province Study in China

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Background

Many factors affect the stability of iodized salt, including temperature, humidity, package material, salt purity, and storage condition and duration. The salt industry needs information on these factors in order to choose the proper level for optimal salt iodization, and the Ministry of Health needs it for setting up criteria for evaluation of qualified salt samples while monitoring salt iodine at the household level. To meet these needs, we carried out a multiple province study on the stability of iodized salt over a one-year period from April 2000 to May 2001, collecting and storing salt samples locally in different packages and under different conditions.

Materials and Methods

A total of 572 salt samples produced by 58 salt plants (half of the 115 state factories in China) were collected from 31 provinces and additionally from the city of Dalian. They included refined (purified salt, crushed (washed salt, sun-evaporated salt and four types of raw salt. Table 1 describes storage conditions for each sample. Kitchen samples were stored either in a container with cover, a sealed small plastic bag (0.5 kilo), or an open small plastic bag (0.5 kilo). Samples in factory storehouses were all packaged in big sealed sacks with polyethylene lining (50 kilo). The temperature and relative humidity in kitchen and storehouse were recorded once per week. Samples from each package were taken with thorough mixing on the first day and after 3, 6, 9, and 12 months of storage, and then sent to Tianjin

Medical University for measurement of iodine content by titration. SPSS (version 10.0) was used for data processing and analysis, by ANOVA and Multiple factorial analysis.

Results

A total of five measurements of iodine content were conducted on each sample - initially and after 3, 6, 9 and 12 months of storage (Table 2). There was no difference in mean iodine content among the five measurements ($F = 1.792$, $p = 0.128$) indicating no iodine loss during the one-year period under the different conditions of packaging and storage.

Some variations of iodine content were found in all samples when compared with their baseline value. The probability of a positive deviation was close to that of a negative deviation, again indicating no iodine loss (Figures 1 and 2). On multifactorial analysis, the raw salt, crushed/washed salt, sun-evaporated salt, and sack-packaged salt were associated with larger variations in iodine content. Although the iodine content of the salt in three kinds of packages stored in the kitchen showed no significant differences, we observed a trend towards less variation in the sealed small bag, moderate variation in the container with cover, and larger variation in the open small bag.

Temperature and humidity affected the iodine content of salt. The concentration increased with lower temperature and humidity in the kitchen during the autumn and winter, but not in the sealed large sack stored in the factory, suggesting that the water-proof sealed sack could avoid influences from temperature and humidity (Table 3).

Table 1. Summary of salt samples for the study

Packing	Storage	Salt				Total
		Refined/purified	Crushed/washed	Sun-evaporated	Raw	
Container with cover	Kitchen	104	36	15	3	158
Sealed small bag	Kitchen	104	36	15	3	158
Open small bag	Kitchen	104	36	15	3	158
Sealed big sack	Factory store	65	21	10	2	98
Total		377	129	55	11	572

Table 2. Mean iodine content over time

Period of storage	n	Salt iodine (mg/kg) mean ± SD
0 day (baseline)	572	45.33 ± 10.45
3 months	572	45.99 ± 12.17
6 months	572	46.33 ± 11.89
9 months	565	46.91 ± 12.00
12 months	560	46.89 ± 12.21

Discussion

The iodine content of most salt samples in this study was very stable without significant loss after one year of storage. Variations in iodine content occurred in all samples, but this did not imply iodine loss because decreases in iodine content were equaled by increases. Changes in iodine content in unrefined salt with large particles, such as raw salt and crushed/washed salt, may result from inhomogeneity in the iodization process, and change in unpurified or water-rich salt, such as crushed/washed salt and sun-evaporated salt, may stem from migration of iodine within the packaging associated with changes in humidity during storage, if the collected sample was not thoroughly mixed. The increased iodine content with lower temperature and humidity may reflect evaporation of water from the salt. The packaging material used for iodized salt was generally satisfactory for iodine stability.

Our results differ from some of those previously reported (1-4), but most other studies were based on a single packaging method and set of storage conditions, or a limited number of samples. In contrast, we examined four types of salt manufac-

Table 3. Increase of iodine concentration with decreased temperature and humidity during kitchen storage.

Period of storage	n	Salt iodine (mg/kg) mean ± SD	Temperature C°	Humidity %
0 day (baseline)	474	45.10 ± 10.42	—	—
3 months	474	45.47 ± 11.51	25.01 ± 5.04	67.35 ± 14.30
6 months	474	46.05 ± 11.34	25.75 ± 5.5	68.93 ± 4.03
9 months	474	46.73 ± 11.73*	15.75 ± 4.84	66.32 ± 7.26
12 months	465	46.85 ± 12.24*	16.06 ± 5.26	65.99 ± 8.31

* *p* < 0.05, compared to the baseline value

tured from 58 factories, in different packages over a one-year period, and our results provide a more comprehensive picture of salt stability in China. Other scientists in China have obtained similar results in recent years (5-6).

Conclusions

Under current packaging conditions in China, salt iodized with KIO₃ is very stable with no iodine loss from production to household. Salt should be adequately mixed when re-packaged from large sacks into small plastic bags. Additionally, the salt industry should further improve the homogeneity of its product. Refined(purified salt is best for iodization since it showed less variation in iodine content. We suggest to the Ministry of Health that 25% of relative bias (the 95th percentile value) be the criterion for accepting salt as adequately iodized in monitoring at the household level.

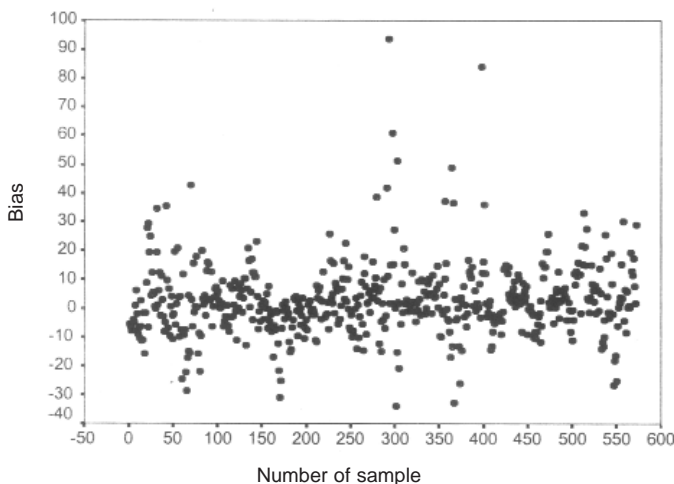


Figure 1. Variations of iodine content over one year for 572 samples. Most were very stable.

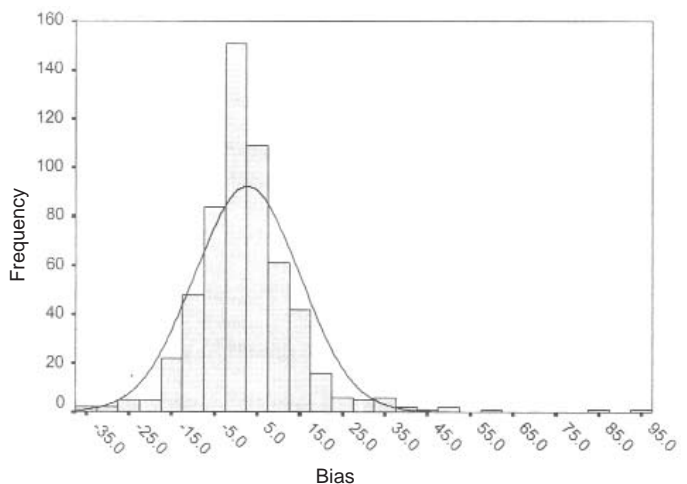


Figure 2. Distribution of variation in 572 samples based on five measurements over one year.

Summary

We collected a total of 572 salt samples from the entire country and stored them locally in kitchens and factory store-houses under different packing conditions for one year. The room temperature and humidity were recorded regularly. Every three months samples from each package were measured for iodine content. The mean iodine content did not differ among five times of sampling, indicating no iodine loss over one year. All samples showed some variations in iodine content when compared with their baseline value, but the negative variation was almost equal to the positive, again indicating no iodine loss. Salt that was raw, crushed(washed, sun-evaporated, or sack-packaged) had more variation in iodine content, and temperature and humidity also had important effects. We conclude that salt iodized with KIO_3 is quite stable with no iodine loss during one-year storage. The salt quality, storage conditions, homogeneity of the iodization process, and sample collection are important contributors to large variations in iodine content. ■

ACKNOWLEDGEMENT

We thank our 32 colleagues from different parts of the country for sending the salt samples during the study period, and Dr. Ray Yip, Senior Adviser, Area Office of UNICEF in Beijing, for helpful advice.

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Swat's Success with Salt Iodization

BY DR. MOHAMMAD RAFIQ, Deputy Director, DHDC Swat, NWFP, Pakistan



COURTESY DR. RAFIQ

Young woman with iodine deficiency goiter, Swat, Pakistan.

High beautiful mountains, clear green water flowing through the heart of the valley, blue skies, and a smoke-free environment make the Swat district of Pakistan's Northwest Frontier Province (NWFP) a major attraction for visitors, nationals and foreigners alike. While the environment of glaciers, snow-covered mountains and free-flowing river make Swat any tourist's dream, it also leaches iodine from the soil, leaving only a tiny amount to meet the daily needs of the people. The disorders caused by the resultant iodine deficiency include infertility, abortions, stillbirths, mental and physical handicaps, cretinism, squint, goiters, and low IQ.

The problem of iodine deficiency has been known in this area for almost a century, since Sir John McCarrison published his study of the adjacent district of Chitral in 1906. In 1987 the government of Pakistan, in collaboration with UNICEF, launched a crash program of iodized oil administration in the Northern Areas, AJK and Swat district, but after a decade of operation, the program was rolled back due to high operational cost and lack of technical staff.

In 1989 when the iodized salt project was launched through Utility Stores Corporation, Swat was the first district to introduce iodization into the private sector, in 1993. Since then, the district has attracted the attention of IDD control activities on a regular basis. When salt iodization was officially applied to the private sector, the response from local producers was limited, and remained so until 1997, when about 20 per cent of the salt produced locally was iodized. Also, the demand was almost negligible and the level of motivation was very low. The scenario, however, has changed over the years. Now there are 12 salt producers, providing 750 metric tons of salt for a total population

of about 1.2 million; all of it is iodized, it is available throughout the district, and the price has not increased.

How was success achieved?

The idea of having a district IDD control committee was envisaged in 1997. The Deputy Commissioner, by virtue of his designation, was made chairman, while the District Health Officer was nominated as the secretary of the committee. Members included the Dean of the Islamic School, the Assistant Director of Physical Education (Education Department), the Superintendent of Police, the District Leader of Scouts, the ISSF field manager and the district Nutrition Officer. The writer was technical advisor to the committee, with additional responsibilities of keeping liaison with the donors and of record-keeping. Great care was taken in the selection of committee members, and this provided an opportunity to have a small but highly functional task force.

Five major tasks were targeted: Production, Supply, Demand Creation, Quality Control, and Sustainability. To make the product available to the entire community, a series of meetings was conducted with the salt producers. Their problems, mostly related to the district administration, were identified, and resolved. To make the producers aware of the IDD problem and iodized salt, they were briefed in detail. The Dean of the Islamic School played an important role in the motivation campaign. The other factor that influenced the producers was the certificate of commendation issued by the deputy commissioner to those cooperating with the committee. Food-manufacturing licenses were issued not only at a subsidized fee, but the same were provided at their doorsteps. A trade union of salt producers was encouraged, which helped the committee in communicating its message easily. Feelings of ownership were extended and the role of the committee was always described to the producers as supportive in nature. Providing the mixing equipment in their factories and providing potassium iodate through the local market at a standard price also encouraged confidence.

At the same time, attention was given to supply and demand creation. An extensive promotion campaign was launched. The Dean of the Islamic School himself visited almost all tehsils of the district and gave a speech to the religious leaders of the area who were invited for the purpose. This proved very helpful because in several cases the local religious leaders mentioned the problem in their sermons in mosques. The Health Department arranged a one-day briefing for all the persons in charge and women health visitors of the local health units. They were directed to incorporate health education messages in the already existing village health committees, which were also given the responsibility of both educating the community and motivating local shopkeepers to sell iodized salt. The Education Department and scout leaders also played their part by training either a school teacher or a scout leader in every middle and secondary level school to educate and brief students of class V and above. The idea was to make them able to answer the following five IDD-related questions: (1) What is iodine? (2) If our food is iodine-deficient, what happens to our body? (3) How can we get iodine? (4) What are the benefits of using iodized salt? and (5) How can we recognize iodized salt? Answers were kept simple and mostly related to the disorders and benefits that would interest a child.

This approach proved extremely fruitful for demand creation in a community where children are usually the ones to buy salt from the local shop, and also provided a quality-control tool,

Despite its natural beauty Swat harbors deadly iodine deficiency.

because these schoolteachers and scout leaders became actual resource persons in their own communities.

The Nutrition Officer took over the responsibility of arranging seminars for NGOs, and they subsequently were able to spread awareness in the communities. In certain cases, NGOs generated promotional material even from their own resources. ISSF, for instance, helped in the promotion by word of mouth and printed material. Supply was ensured through the village health committees and local revenue tehsildars. There was no price difference in ordinary and iodized salts, so shopkeepers and consumers had no problem on that count.

Quality control measures were adopted through regular visits, and samples were collected by the Nutrition Officer, food inspectors, and ISSF field manager. Revenue tehsildars and SHOs were also authorized to check iodization levels with a simple rapid test kit. Students were asked by their teachers to bring one teaspoonful salt from their homes, and 50 random samples were tested quarterly with test kits, and the results were sent to the technical advisor.

Members of the district IDD committee also monitored the situation by routine visits. Salt producers were motivated and an agreement was signed with them to the effect that the packaging must have their address and license numbers and preferably a short message on the benefits of iodized salt. Samples were also collected from retail shops, and traced back with the help of the printed address.

Obstacles

As could be expected, the committee faced quite a few obstacles, including family planning rumors, newspaper articles against iodized salt, lack of a supplies system, availability of non-iodized salt from neighboring districts, and packaging without logo or address of the producers.

The family planning rumors and the hostile newspaper articles were countered through mass interpersonal communications, especially through religious leaders. The supply of non-iodized salt from other districts was curtailed by meetings with the relevant deputy commissioners to control their salt producers and make them agree to undertake the production of iodized salt and by providing the check-post staff with rapid test kits to inspect salt at all entry points. Retailers were warned through notices from the health authorities not to buy salt without proper sale receipts.

Packaging labels were one of the major obstacles. The price of a salt production unit is 20 to 25 thousand Pakistani rupees, while the packaging with logo and address costs almost 30 to 40 thousand for the first time, and then at least 2-3 paise subsequently for every bag. By issuing the food license the salt producers were bound to use their own packaging.

The future

Sustainability was a prime concern for the committee, which itself had a short tenure but needed to ensure long-term compliance. To achieve that target the following measures were adopted:

■ A sense of ownership was generated among the salt producers. They now look after the program more closely than anybody else could. They have organized a divisional trade union of iodized salt producers, thus working on their own to produce and promote iodized salt not only in the Swat district, but in other districts as well. Moreover, the salt producers have willingly not raised the price.

■ The technique of adding iodate is simple and its cost negligible, so the salt producers will not revert to non-iodized salt.

■ The iodizing equipment (drip mixing) has helped the laborers in settling the salt dust; they prefer keeping the drip open to minimize the dust.

In view of these steps, the demand for iodized salt is great and should sustain itself and ensure progress.

Monitoring and quality control have been incorporated within the government system. The district management, tehsildars, SHOs, food inspectors and teachers are permanent employees and will remain area-bound. They will monitor progress, and also carry on the promotional activity without external support.

The only potential threat to the program is the unavailability of mixing equipment and potassium iodate in local markets. A proper system at federal and provincial levels is required to import and distribute iodate and to provide mixing equipment for remote areas. In case donors are not available, we must have our own system to operate without any external help. The cost of iodization is so negligible that we should feel ashamed of looking to donors for such a high-stake program.

Recommendations

From our experience, the following recommendations should be considered for advancing progress towards universal salt iodization in Pakistan:

- more awareness among policy-makers;
- political commitment by the government;
- Federal, Provincial, Divisional and district involvement by identifying a motivated focal person to work as a catalyst;
- involvement of Food, Health, Education, Industrial & Information departments;



COURTESY DR. RAFIQ

Dr. Mohammad Rafiq, third from left, with cretins in Swat, Pakistan.

- distribution system of KIO_3 drip equipment at gross roots level;
- incorporation of a government-level monitoring mechanism;
- mobilization of Education, Health and Information departments to educate the community; and
- incentives for salt producers.

Conclusions

Key elements in the success have been: dedication to the cause; excellent teamwork; involvement of highly relevant stakeholders in the committee; mutual respect among team members; involvement of salt producers in the process; appreciation of good work; punishment for cheaters; and active cooperation of UNICEF's chapters in Islamabad and Peshawar.

Although the writer remained part of the whole process, his most effective role was as catalyst, especially in keeping progress going, and informing, encouraging and appreciating the efforts of all the individuals concerned. The stage has been reached now, where the program, by the grace of God, should run on its own and continue to benefit the community. ■

Key elements in the success have been: dedication to the cause; excellent teamwork; involvement of highly relevant stakeholders in the committee; mutual respect among team members; involvement of salt producers in the process; appreciation of good work; punishment for cheaters; and active cooperation of UNICEF's chapters in Islamabad and Peshawar.

Worth the Salt: Fighting Iodine Deficiency in Azerbaijan

This article and illustrations were contributed by Mr. Akif Saatcioglu and colleagues at UNICEF/Azerbaijan.

In an idyllic setting, the last words someone expects to hear is “Our water is bad.” However, these words are echoed throughout a small mountain town in post-Soviet Azerbaijan. When Zhale Khanjanova, a secondary school pupil in Shaki, was asked what this meant, she replied, “Our water has no iodine.”

After we asked for more information, she informed us that people get ugly goiters if they don’t have iodine. She went on to tell us that now people are using iodized salt which is being sold in the market. When asked how she knows about the importance of iodized salt consumption, she answered they became aware of the importance of consuming iodized salt in the schools. We wondered who was sponsoring the program. She told us it was UNICEF.

An idyllic setting disturbed

Nestled in the skirts of the Greater Caucasus Mountains lies a town that has served as a regional trading center for more than 2000 years. From its location where Europe meets Asia, Shaki has seen its share of history and has greatly benefited from travelers and empires that have passed this way. Now, though, this sleepy mountain town seems to have been forgotten as its recently independent republic deals with a large population of Internally Displaced Persons (IDP) and a potential oil boom while seeking political and social stability. Where Shaki once hosted a healthy tourist trade and had access to goods through the Soviet system, these contacts have trailed off.

Prospects admittedly seem limited. The depth of the problem is further revealed if we consider the effects of the transition period on the population. Without a steady flow of goods and services, which in Soviet times reached every corner of Azerbaijan as well as every other part of the then Soviet Union, not only has the quality of life and living conditions dropped off, but the potential of the population has also been negatively impacted.

Fortunately, the rivers in and around Shaki are not the problem. However, iodine is important, and its deficit prevents a very important development challenge.

A nutritional challenge

An example is the increased prevalence of malnutrition and micronutrients deficiencies. These deficiencies come in a variety of guises. One that greatly inhibits a population’s capacity is iodine deficiency disorders (IDD). Iodine is an essential component of the thyroid hormones, which affect many parts of the body, particularly the development of muscles, heart, kidney, liver and the brain. Inadequate levels of iodine leads to insufficient hormone production, a condition collectively referred to as IDD.

This disorder has many forms: mental retardation, other defects in development of the nervous system, goiter (enlarged thyroid), physical sluggishness, growth retardation, reproductive

In 2001, the Parliament of the Republic of Azerbaijan passed a law on Preventing Iodine Deficiency Diseases (IDD). Article 8.3 of the Azerbaijan Law defines that “Import, sale and production of non-iodized salt for nutrition and fodder purposes to the territory of the Republic of Azerbaijan shall be prohibited.”

failure, increased childhood mortality, and economic stagnation. The most devastating of these consequences are on the development of the human brain.

IDD can be easily prevented. People need only a trace amount of iodine in their regular diet. An efficient and cost effective way of obtaining the iodine is through food fortification and a good example is iodization of salt, a nutrient widely consumed by the population. To get the utmost benefit from the salt iodization, all salt for animal use should also be fortified, since such salt is often consumed by people, and improving the iodine status of animals will improve animal reproduction, the yield of milk and meat, and also the iodine content of food.

A new problem

Azerbaijan never used iodized water in the past. Rather, iodine delivery came from fortified salt. Average salt intakes vary considerably according to climates, culinary habits and occupation. In Azerbaijan where hot summers and heavy workloads result in excessive sweating and salt loss, people consume 15-20 grams, more than the worldwide coverage.

The Soviet system made it compulsory that iodized salt reach even the smallest villages high up in the mountains. Therefore, IDD did not reach such high epidemic levels. After independence, people throughout the Caucasus and Central Asia did not get enough iodized salt. Diminished social services provide a partial explanation, but this deficit was more due to changes in the market and transport links. Non-iodized salt began to show up and iodized salt almost disappeared. It was at this time that IDD began to be observed throughout these republics, especially in endemic areas.

Azerbaijan in general has always been an endemic region for IDD. A year 2000 study of iodine intake and goiter prevalence among schoolchildren reports a particularly high prevalence (86%) throughout Azerbaijan. In the mountainous regions of the Caucasus, the prevalence reached 100%, while coastal areas were 60%. Household consumption of iodized salt had dropped to zero throughout the Caucasus and Central Asia, by far the worst level in the world.

The challenge then was to find a way to get iodized salt back into the homes and diets.



COURTESY UNICEF/AZERBAIJAN

Children are trained on the importance of iodine deficiency and its correction as part of child-to-child and child-to-parent approach.



COURTESY UNICEF/AZERBAIJAN

Children in refugee camp wearing T-shirts advocating iodized salt consumption, bearing the logo of Kiwanis International in recognition of their support to the program.



COURTESY UNICEF/AZERBAIJAN

Children in refugee camp actively involved in community-based education on IDD and consumption of iodized salt.



COURTESY UNICEF/AZERBAIJAN

Middle-aged natives of Shaki, Azerbaijan, with goiters from iodine deficiency.

Answering the challenge

The Government of Azerbaijan in cooperation with UNICEF picked up the challenge. It was recognized that IDD restricted the capacity of the population, especially of children. All relevant organizations and institutions understood the need for a program in order to secure the country's potential. Local counterparts, especially the Ministry of Health, and the Ministry of Education, were already aware of the problem but weren't certain how to proceed.

The answer seemed apparent - to ensure universal salt iodization and to ensure access to iodized salt by the population throughout the country. However, to reach this goal required effort. The extent of the problem was assessed and plans were drawn up with the help of local and international experts. Local authorities, officials, parliamentarians, schools and non-governmental organizations also joined in. The National Interagency Committee on IDD/USI was formed, and coordination with regional partners helped to drive efforts. The decision to initiate the Universal Salt Iodization program was taken by the Government and UNICEF for the period of 2000-2004. The program has been supported by Kiwanis International Foundation, which has been aiding USI and IDD elimination efforts worldwide.

To address all aspects of IDD/USI in a coordinated and integrated fashion, the program has a variety of components:

- A public awareness campaign was set into motion.
- Advocacy meetings have been held with all counterparts and partners.
- Communities were involved, with the help of civil society organizations.
- A national seminar promoting advocacy, awareness and social mobilization was held.
- The National IDD Laboratory Training Center for monitoring IDD and salt iodization was provided with training equipment.
- Training in laboratory techniques and monitoring was conducted.
- Regular meetings were organized with salt producers, and a partnership was developed.

- Local factories were studied and assisted so that they could begin to iodize their salt.
- Importers were contacted and requested to bring in only iodized salt.
- The state salt factory in Naxcivan and a private factory in Baku are producing iodized salt.
- A national law on the Prevention of Iodine Deficiency Disorder was passed - legislation that makes salt iodization compulsory and will disallow import of non-iodized food grade salt.
- Child-to-child and child-to-mother delivery strategies were adopted so that salt could get into households throughout the country.
- IDD test kits were provided to the Ministries of Health and of Education for joint testing. These test kits were distributed to schoolchildren for rapid measurement of iodine in salt at home with subsequent classroom reports of findings.
- A monitoring and surveillance system to check iodized salt production, retailing, importation/exportation and consumption has been established.
- Local laboratories and related institutions are being strengthened for monitoring purposes.

The project on USI has made real progress and is expected to have great impact on reducing the prevalence of IDD in Azerbaijan. Household consumption of iodized salt was zero percent in 1999, but reached 41% the next year. It is estimated that 80% of all households now consume iodized salt, a result of the integrated approach taken by UNICEF, the government and all of their partners.

The success of this program attests to the effectiveness of all partners in identifying and implementing realizable measures to help guarantee a good future for vulnerable populations. It also exemplifies an integrated approach for development. Preventative measures were not emphasized by the Soviet health system. The involvement of Azerbaijan's health professionals and officials in this project confirms their commitment to such practices.

Ultimately, this program directly targets the potential of the population by presenting innovations that lay the basis for their foundation. This young republic needs people who are creative and active, ones who are fully developed in every capacity. Eradicating IDD removes a serious physiological obstacle to this development. Iodized salt is essential for the young people of Azerbaijan to realize their potential.

Worth the salt

"My mother always bought iodized salt. She knew it was important for us. Before it didn't taste good, but now it is quite tasty."

Faiq Aleskerov, secondary school student

Faiq is a young chess champion in Azerbaijan and is very active in his school and community, perhaps as a result of his mother's commendable attention to his health and welfare. He

AZERBAIJAN'S SALT

Salt is a natural resource in Azerbaijan, either from near the Caspian Sea, from lakes or salt mines. However, this salt is not currently iodized as the processing facilities had fallen into disrepair. Local salt resources still made it to market, but with no regard for this nutritional additive. Suppliers began to supply Azerbaijan with salt from other countries, and their products appeared in bazaars and shops throughout the country. Most of it, again, was not iodized.

A local private salt producer based in Baku and a USI partner, not only has begun to produce and supply iodized salt to the whole country, but it does so at a very competitive price. Its 750gr pack costs only 400 Azeri Manat. That's about 9 cents (US), very important considering the extremely poor economic conditions of the population.

More impressive is that the back of the packaging includes information concerning the importance of iodine for a person's health and well-being. It lists what can result if a person does not receive enough iodine, and instructions are given to promote proper usage. The package even provides a phone number to call in order to learn more and shows certification from the Ministry of Health.

serves as a fine example of his generation's potential, but was one of the very few who has continuously had iodine in his regular diet.

During the early years of independence, some iodized salt did find its way to Shaki. However, it was expensive, sometimes three times the cost of non-iodized salt, and some was of poor quality. Thanks to the USI program, iodized salt can now be found all around Shaki. Some stores only sell iodized salt, a change from a few months ago. Soon all young people, as well as their families and neighbors, will be getting the salt and iodine that they need.

An old adage speaks of a man being worth his salt, reflecting a time when salt was a precious commodity. In Azerbaijan, the future depends on the young people. The youth who make up this precious commodity—Faiq, Zhale and all the children of Shaki—are definitely worthy of the iodized salt that is being provided. ■

ABSTRACTS

RE-EMERGENCE OF IODINE DEFICIENCY IN AUSTRALIA. *Li M, Ma G, Guttikonda K, Boyages SC, Eastman CJ, Westmead Hospital, Westmead, NSW, Australia. Asia Pacific J Clin Nutr 10:200-203, 2001.*

Studies from about 10 years ago reported that the median urinary iodine excretion in Australia was around 200 mcg/day. More recent information suggested that the urinary iodine concentration was declining so the authors studied four groups in Sydney. The results showed the following medians: school-children (94), 84 mcg/L; healthy adults (63), 88 mcg/L; pregnant women (101), 88 mcg/L; and diabetics (85), 69 mcg/L. The ranges for the four groups were from 12 to 312 mcg/L. These findings were similar to those from other recent studies in the Sydney area showing median urinary iodine levels ranging from 64 mcg/L in normal volunteers to 104 mcg/L in pregnant women. These levels were about one-half those reported a decade ago. Much of the iodine in the Australian diet came from the use of iodophors in the dairy industry, which now trends towards non-iodine-containing microbicides. Although iodized salt is available, only 10% of households use it at table, and the food industry does not use it widely, as far as it is known. The authors state "we have an extraordinary situation in Australia where the community has been dependent upon contamination of a staple food for an essential micronutrient." They call for a systematic national survey of iodine intake and of iodine nutrition markers.

IMPROVED IODINE STATUS IS ASSOCIATED WITH IMPROVED MENTAL PERFORMANCE OF SCHOOL-CHILDREN IN BENIN. *T. van den Briel, C. E. West, N. Bleichrodt, F. J. R. van de Vijver, E. A. Ategbo, and J. G. A. J. Hautvast. Am J Clin Nutr 72:1179-1185, 2000.*

The authors studied 196 schoolchildren, aged 7-11 in the north of Benin, an area with moderate iodine deficiency. The

initial median UI was 0.16 micromol/L (20.6 mcg/L). Other nutritional issues were stunting (33%), low weight for age (17%), wasting (2%), and anemia (33%). Some children were given iodized oil (Lipiodol 540 mg iodine) orally, or placebo. Because iodized salt became available during the course of the study, follow-up results were related to changes in urinary iodine concentration. Mental performance was assessed by adaptation of existing tests, including block design, five tests from the African child intelligence tests (closure, concentration, exclusion, fluency, and mazes), hand movements, and colored progressive matrices, as well as two psychomotor tests - peg-board and ball throwing. One year later the same tests were administered, as well as obtaining urinary iodine and other biochemical measures. In the improved group, the urinary iodine excretion increased from 0.09 to 0.68 micromoles/L, compared with 0.62 to 0.67 micromoles/L in the unchanged group. For the two groups (improved vs. unchanged UI), serum thyroglobulin changed from 285 to 95, and 135 to 90 pmol/L; serum TSH from 2.20 to 1.40, and 1.80 to 1.20 mU/L, free T₄ from 11.6 to 13.9, and 12.6 to 14.8 pmol/L, and blood hemoglobin and serum ferritin levels remained fairly steady at approximately 115 g/L and 48 mcg/L, respectively. Compared to children with unchanged urinary iodine concentrations, the improved group showed an overall improvement in mental performance, with a z score of 0.12 (0.06, significant at p = 0.044). Greatest improvement was seen in the exclusion test and the color progressive matrices, suggesting better general abstract reasoning. The results may also indicate improvement in speed of task performance. Overall, the improvement was about 5 IQ points, compared with a study in Malawi by some of the same authors, in which the overall improvement was > 10 IQ points. The authors attribute the improvements noticed in Benin to better iodine nutrition, which could come both from iodized oil and iodized salt. ■



INTERNATIONAL COUNCIL FOR CONTROL OF IODINE DEFICIENCY DISORDERS

The International Council for the Control of Iodine Deficiency Disorders (ICCIDD) is a nonprofit, nongovernmental organization dedicated to sustainable optimal iodine nutrition and the elimination of iodine deficiency throughout the world. The membership includes many disciplines related to iodine deficiency and its correction - endocrinologists, public health workers, salt producers, management specialists, communicators, laboratory analysts, researchers, and others. An international Board of Directors promotes ICCIDD's goals, working in close coordination with countries and international organizations. Support for activities has come from international aid programs of Canada, Australia, the Netherlands, USA, also from the World Bank, UNICEF, and others.

The *IDD Newsletter* is published quarterly by ICCIDD and distributed free of charge in bulk by international agencies and also by individual mailing. The Newsletter also appears on ICCIDD's website in both text files and PDF. The Newsletter welcomes comments, new information, and relevant manuscripts on all aspects of iodine nutrition, including human interest stories on IDD elimination in countries.

For further details about ICCIDD or the *IDD Newsletter*, please consult the website (www.iccidd.org) or contact Dr. John Dunn, Executive Director of ICCIDD and Editor of the Newsletter, at University of Virginia Health System, P. O. Box 800414, Charlottesville, VA 22908, USA, e-mail iccidd@virginia.edu.

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