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Iodine Monitoring, Laboratory Procedure and Iodine Deficiency Disorders Elimination (IDFDE) Programme

*Report of the first training Workshop
New Delhi, India , 17-21 September 2002*

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1. INTRODUCTION

A Workshop to Establish a Urinary Iodine Laboratory Network was organized in Bangkok, between 22-25 May 2001, by the Institute of Nutrition, Mahidol University, in association with Center for Disease Control and Prevention (CDC), Atlanta, World Health Organization (WHO), United Nations Children's Fund (UNICEF) and the Micronutrient Initiative (MI) with other participants being International Council for Control of Iodine Deficiency Disorders (ICCIDD) and Programme Against Micronutrient Malnutrition (PAMM). This was the first in a series of workshops in strengthening the capacity of laboratories around the world to accurately measure iodine in urine and salt.

As a follow-up to the Bangkok workshop, WHO in collaboration with ICCIDD South East Asia Regional Office organized an intercountry workshop on 'Iodine Monitoring, Laboratory Procedures and National IDDE Programmes'. In the context of the South-East Asia Region, the workshop was relevant because there was a long-felt need to have a regional network to monitor the iodine content of salt and the urinary iodine excretion. There are many independent laboratories conducting both salt and urinary iodine analysis; a system for providing regular exchange of samples between the laboratories is required. One of the important issues discussed in the workshop included setting up of standardized internal and external quality control protocols, regardless of the methods of estimation being used. Quality epidemiological data in terms of salt iodine and urinary iodine depends on the laboratory practices and methods that conform to international standards. It is envisaged that the presence of trained laboratory managers and other technical professionals in key centres in each country who can further train others in the sub-national / regional laboratories will help fulfil the goal of decentralized and sustainable capacity building.

The objectives of the workshop were:

- (1) To introduce and sensitize the participants to the relevant issues in Iodine Deficiency Disorders and National Programmes to eliminate iodine deficiency;

- (2) To train and reinforce training for the participants in the estimation of iodine content of salt by iodometric titration;
- (3) To introduce participants to the concept of annual cyclic monitoring, and
- (4) To visit a modern salt iodization plant for familiarizing participants with the process of salt iodization.

2. INAUGURAL SESSION

In the opening address, the guests and invitees were welcomed by Prof V P Reddaiah, Head, Centre for Community Medicine, All India Institute of Medical Sciences. Prof M G Karmarkar, Senior Advisor, ICCIDD outlined the broad aims and objectives of the workshop. Dr Keith W Bentley from the World Health Organization talked about the need for monitoring and laboratory procedures in IDD Elimination Programmes. Dr R Sankar, National Programme Officer, the Micronutrient Initiative, summarized the role of the Micronutrient Initiative in elimination of Micronutrient Malnutrition. Prof P K Dave recalled the historic association between the All India Institute of Medical Sciences and the National Goitre Control Programme and the need to sustain elimination efforts through constant monitoring. Prof N K Ganguly emphasized the need for collaboration in public health programmes. He encouraged the participants to make efforts to inform the community about the benefits of consuming iodized salt. Dr C S Pandav gave the vote of thanks.

The participants were provided a workshop kit which contained the conference background papers related to urine and salt iodine estimation and a laboratory manual. The session started with the screening of the film 'Trishna', made by a documentary film-maker, late Mr Ishwar Chandra Pandey, who tragically lost his life during the film shoot. The film was commissioned by the Union Ministry of Health as an audiovisual module to sensitize people on iodine deficiency disorders.

The workshop programme and the list of participants are enclosed as Annexes 1 and 2.

3. COUNTRY PRESENTATION

Prof Quazi Salamatullah presented the history of IDD elimination efforts in Bangladesh. Dr Renuka Jayatissa presented data from a recent survey conducted in Sri Lanka. Dr S Ranganathan from India presented the research activities from the National Institute of Nutrition in Hyderabad. The Institute is presently in the midst of a national survey where a specific district from each state in the country is being surveyed to assess the impact of the iodized salt programme. Dr Arun Kumar Aggarwal from the Post-Graduate Institute, Chandigarh, India presented data from IDD survey being carried out in the northern region of the country. Dr Bimal Rai from the Ministry of Health, Sikkim, India talked about the components of an effective IDD Control Programme in Sikkim.

As part of the course work, the participants were asked to prepare country-specific project proposals, details of which were discussed in later sessions.

The participants were informed about the spectrum of iodine deficiency and its consequences; global and regional epidemiology of iodine deficiency; means to eliminate iodine deficiency; indicators for tracking progress towards sustaining elimination of iodine deficiency disorders, and interpretation of the indicators to assess the IDD status in a community.

The Kerala survey was used as a model for participants, survey methodology, process of involvement of stakeholders, practical problems encountered during field survey, sample collection and storage, data analysis and interpretation and the management of an IDD Survey. The importance of monitoring in IDD elimination programmes and relevance of laboratory indicators (urinary iodine excretion and iodine content of salt) was discussed. The concept of cyclic monitoring and the case study of Bhutan, where cyclic monitoring has been introduced with great success, were analyzed.

Estimation of Iodine in salt

Although participants were familiar with the basic principles of laboratory procedures for iodine estimation in salt, the chemical basis for the laboratory test was explained in detail. This was a refresher class in the theory behind the practical. The concepts of internal and external quality assurance, the maintenance of records and registers and the precautions to be taken while handling chemicals, glassware and instruments, were detailed. The

importance of a Levy Jennings plot for maintenance of internal quality control was explained.

The workshop venue then shifted to the laboratory where the preparation of reagents was done. The participants prepared sodium thiosulphate, 2N sulphuric acid and potassium iodide. Some known value samples were taken and the procedure was practically demonstrated. The participants learnt to use the automatic dispenser and burette and the precautions to be taken while performing salt analysis.

Self Performance of Salt Iodine Estimation

Eight samples of the known value sample pool were provided to the participants and each participant conducted the procedure for estimation of iodine in salt. They calculated the mean, standard deviation and coefficient of variation (which were 26.2 ppm, 1.3 ppm and 5%) for the samples analyzed.

Estimation of Iodine in Urine

The participants discussed the Sandell Kolthoff reaction, which is the chemical basis for urinary iodine excretion. They also reviewed the various methods available for urinary iodine estimation, as mentioned in the laboratory manual. In the laboratory, the reagents. Ammonium persulfate, 5N sulphuric acid, arsenous acid solution, ceric ammonium sulfate and iodine calibrators were freshly prepared with the help of the participants. The samples brought from Chandigarh were loaded on to two plates along with the calibrators, and digested and analyzed in the microplate reader. The participants then loaded one plate with the iodine calibrators and were familiarized with the use of micropipettes and the precautions to be taken while doing urine iodine estimation. Many improvisations and improvements were suggested by the participants.

The urine samples which were sent for digestion were analyzed separately by the participants. The skills that were taught to the participants were: the use of the sealing cassette; use of a micropipette; transfer of samples between plates; precautions in the use of pipette tips; and washing of glassware and reagent bottles.

The participants then discussed the lacunae in research in the field of iodine deficiency disorders in different countries.

Presentations were made about the future course of activities that might be undertaken by them on return to their respective countries. The country issues are attached as **Annex 3**. The participants were encouraged to approach bilateral and international funding agencies for carrying out the planned research activities in their respective countries. The Regional Network for South-East Asia, which is planned to be established, would assist them in every way.

The participants found the workshop relevant and useful. It also served as a platform from which the regional network could be launched. They learnt more about new and emerging technologies and the application of the same to their work. Questions and doubts about the laboratory procedures were answered during the interaction with the leading experts in the field. The participants also appreciated the personal touch given to the conduct of the workshop, ranging from the background material to the personalized laboratory apparel for the participants.

Closing Ceremony

On behalf of WHO, Dr C S Pandav, Coordinator, ICCIDD thanked all the participants for their enthusiastic participation, which made the difference between the success and failure of the workshop. Mementoes and certificates were given to all the participants. The participants then departed for Chandigarh to visit the laboratory of the Post Graduate Institute of Medical Education and Research. This trip replaced the originally planned visit to an iodization plant in Jaipur.

4. CONCLUSIONS AND RECOMMENDATIONS

These were as follows:

- (1) It was affirmed that among the methods reviewed in the workshop for urinary iodine estimation the simple microplate method is the most cost-efficient. After initial expenditure, the recurring cost and the cost per sample with this method is relatively less. The workshop recommended

that this method be adopted by all the laboratories in a time bound manner.

- (2) Among the indicators used for assessing the IDD status in a population, laboratory measurements are the only objective values. This makes it vital that the quality of the procedures to make the laboratory measurements is ensured. In this context, there is an urgent need for a regional network of iodine monitoring laboratories. The regional network would be called the Regional Network of iodine monitoring laboratories for South East Asia (RNSEA). The proposal for formation of the network is envisaged as a three step process:

Step 1 – All the laboratories which are presently using the microplate method standardize their methodology, their processes and begin an external quality assurance programme;

Step 2 – The other labs in India (Hyderabad, Sikkim, Chandigarh), Nepal, Bhutan, Pakistan, Myanmar and Maldives can be inducted into the Network after they have established the microplate method in their laboratories;

Step 3 – With a common method and protocol, there can be an exchange of samples whenever any of the participant laboratories undertakes a project on iodine deficiency disorders.

- (3) The reference laboratory will initially be located in the ICCIDD Laboratories in New Delhi. It is proposed that there be a cyclical shifting of the reference lab between the participating laboratories so that all laboratories are familiar with the functions of a Reference Lab. This serves as an excellent capacity building exercise within the framework of a regional Network.
- (4) Some of the laboratories in the Region are currently using the spectrophotometric method for estimation of iodine in urine. They are also involved in estimating the iodine content of salt. These laboratories should be provided with financial resources to establish the microplate method in their labs.
- (5) A published resource base on the quality control process and procedures to be followed by a reference laboratory is needed. This can be in the

form of a Manual on Standard Operational Procedures in an Iodine Monitoring Laboratory.

- (6) In most of the countries an iodized salt programme is being implemented, but there is a need to introduce cyclic monitoring in all these countries.
- (7) A similar workshop should be conducted for the other countries of the Region, who could not attend the present one due to participation limits.
- (8) The workshops should be repeated in the different participating laboratories on an annual basis to improve the capacity of the peripheral laboratories.
- (9) The formation of global network linking up to the regional, national and sub-national networks to serve as resource centres for their respective areas should be considered. These networks were envisaged to be a part of a technically harmonized network tied to one accuracy base, which would enable the comparability of results across regions and programmes.

Annex 1

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PROGRAMME

DAY 1 Tuesday, 17 September 2002:

Inaugural Session

- 0915 hrs Welcome
0920 hrs Theme Setting
 IDD Programme – A Perspective from International Organizations
0930 hrs World Health Organization
0945 hrs The Micronutrient Initiative
1015 hrs Address by Chief Guest
1030 hrs Address by Guest of Honor
1100 hrs Vote of Thanks

Scientific Sessions

- 1130–1330 hrs Theory Classes on Iodine Deficiency Disorders
- Iodine AND thyroid hormone – physiology & biochemistry
- Iodine deficiency – mechanism
- Spectrum of IDD and its consequences
 - Epidemiology – worldwide and india
 - IDD Control – why and how?
 - Monitoring IDD control
 - Indicators of IDD
- 1430-1530 hrs Documentary film TRISHNA
- 1530-1700 hrs Country presentations
- Sri Lanka
 - Bangladesh
 - NIN, Hyderabad, India
 - Government of Sikkim
 - PGI, Chandigarh, India

DAY 2 Wednesday, 18 September 2002

- 0930-1100 hrs IDD survey
- Methodology
 - Sample Collection
 - Storage and Transportation

- Basic principles of laboratory procedures for iodine estimation in salt and Urine
- 1130–1300 hrs Quality assurance in laboratory procedures
Precautions to be taken for iodine estimation
- 1400–1700 hrs Preparations for reagents for iodine estimation

DAY 3 Thursday, 19 September 2002

- 0930–1100 hrs Practical demonstration of iodine estimation in salt
- 1130–1300 hrs Individual salt iodine estimation
- 1400–1700 hrs Practical demonstration of iodine estimation in urine

DAY 4 Friday, 20 September 2002

- 0930–1700 hrs Individual iodine estimation in urine

DAY 5 Saturday, 21 September 2002

- 0930–1130 hrs Country proposals
- 1200–1300 hrs Feedback on the workshop
- 1300–1400 hrs Closing ceremony
- 1415 hrs Departure for Chandigarh

Annex 3

COUNTRY ISSUES

(1) Bangladesh

- (a) Bangladesh proposes to implement the cyclic monitoring system for which a proposal will be enclosed separately.
- (b) As far as the Regional Network for South East Asia is concerned, one laboratory in Bangladesh is already using the simple microplate method of urinary iodine. The cost of estimation and the extra manpower required would be needed when this laboratory at Dhaka University joins the regional network. It is also proposed that salt iodine estimation be a part of the procedures carried out by the iodine monitoring laboratories. Laboratories will be involved, regardless of country.

(2) Sri Lanka

- (a) The laboratory at the Medical Research Institute would immediately join the Regional Network for South-East Asia, as they are already using the microplate method of urinary iodine estimation. They would like to address the following issues:
 - (i) Common method – A laboratory manual setting out the procedures and steps in reagent and standard preparation and the estimation is needed.
 - (ii) Guidelines will be required for salt and urine iodine estimation with the operational and procedural issues listed out.
 - (iii) ISO Certification – there is a potential for ISO certification once the network has a uniform process in place.
 - (iv) Support would only be needed for samples exchange.
- (b) The North Central Province presents a unique picture with adequate urinary iodine excretion, high water iodine content and an unexplainably high goitre rate. A detailed collaborative explorative study which needs support is planned to be carried out in this province.

External assistance of an expert who is familiar with the picture that is being presented is needed.

- (i) An epidemiological study is planned to be carried out with the assistance of the Regional Network for South East Asia.
 - (ii) If it is inconclusive, then animal studies will be carried out with the help of the National Institute of Nutrition in Hyderabad, India.
 - (iii) There have been some studies that link endemic iodine deficiency with endemic fluorosis. If the animal studies also do not throw up any light, then a geological study with Dr Susheela from the Fluorosis Research Foundation will be conducted to explore the presence or absence of any link.
- (c) Neonatal Screening Programme – Sri Lanka is planning to implement a neonatal screening programme that will be piloted in a province and later in the whole country. The government would need a Short Term Consultant familiar with the following issues:
- (i) Establishment of IRMA / RIA method in the laboratory and standardization of the protocols and processes of the estimation. There must also be an inbuilt external and internal quality control programme in the process.
 - (ii) Implementing neonatal screening as a pilot programme in a province and later expanding it to the whole country. This calls for expertise in cost benefit analysis and health economics.
 - (iii) The programme will not be implemented unless there is a facility for treatment and follow-up of the subjects, an inbuilt proviso.
- (d) Cyclic monitoring – With the support of UNICEF, a programme of cyclic monitoring will be established in Sri Lanka. The Regional Network for South-East Asia can assist in the following ways:
- (i) Expert opinion by email on any problems encountered during the implementation; and
 - (ii) Issues related to addressing monitoring in pregnancy and in adolescents.
- (e) Production site monitoring can be strengthened by the use of WYD checker to monitor the iodine content in salt.

(3) India

- (a) *Sikkim* – The success of the Sikkim programme is very well known. There is already an iodine monitoring laboratory functioning in Namchi General Hospital. There are plans to upgrade the laboratory to adopt the simple microplate technique for urinary iodine estimation. A cyclic monitoring system is also going to be implemented.
- (b) *Hyderabad* – Intramural activities are already ongoing in the National Institute of Nutrition. The staff and equipment are in place and project wise involvement is possible.
- (c) *Chandigarh* – The laboratory at the Post Graduate Institute is doing urinary iodine estimation by the spectrophotometric method, which needs to be upgraded to the simple microplate method. With the present capacity, they can analyze 500 samples per month and would require support with the processing charges. They also plan to form linkages with other institutions in the area and conduct awareness campaigns. Also, due to its unique location, they can conduct advocacy at two levels – with the political leadership and also with the community.