Sodium intake and iodized salt in the South-East Asia Region

Report of a regional workshop
New Delhi, India, 29–30 September 2014

World Health Organization
Regional Office for South-East Asia

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Acronyms

CVD	Cardio Vascular Diseases
IDD	Iodine Deficiency Disorders
IQ	Intelligence Quotient
NCD	Non Communicable Diseases
PPM	Parts per million
QC	Quality Control

Executive summary

Increased blood pressure is the leading risk factor globally for death and the second leading risk for disability by causing heart disease, stroke and kidney failure. The World Health Organization is promoting the reduction of salt intake to 5 g/day for adults as a cost-effective strategy to reduce hypertension and the overall burden of noncommunicable diseases, while at the same time promoting universal iodization of edible salt for the prevention and control of iodine deficiency disorders (IDD). Synergizing both programmes by promoting their commonalities and complementarities is an essential component of public health.

As part of the actions to reduce the burden of cardiovascular disease and its subsequent problems, the WHO Regional Office for South-East Asia organized a regional workshop on sodium intake and iodized salt for Member States in the South-East Asia Region. The general objective of the workshop was to strengthen an integrated approach for sodium reduction and salt iodization programmes in the Member States of the Region. The specific objectives included reviewing the current sodium reduction and salt iodization strategies in the Member States of South-East Asia, provide training to the participants in standardized approaches for dietary estimation of salt/sodium and urinary iodine estimation.

The main conclusions from the workshop were that promoting reduction of salt intake to 5 g/day is an essential strategy to mitigate problems associated with cardiovascular disease in the Region. Many countries in the Region are presently lacking in policies, strategies and action plans to reduce dietary salt consumption, while almost all countries have implemented salt iodization programmes to control iodine deficiency disorders. The twin goals of optimizing dietary sodium reduction and salt

iodization are compatible and reducing sodium intake would not jeopardize delivery of iodine to populations through salt iodization, as long as levels of iodine in salt are adjusted, based on regular monitoring.

The key recommendations of the workshop for Member States of the South-East Asia Region include the establishment of baseline dietary salt intakes of populations, public education and behaviour change communication to reduce high dietary salt intakes but, at the same time, promoting use of iodized salt in their products, advocacy for the food industry to reduce salt in processed foods and provision of technological assistance and the setting up of joint national committees to harmonize dietary salt reduction and salt iodization.

1

Introduction

A regional workshop on sodium intake and iodized salt for Member States in the South-East Asia Region was organized by the World Health Organization's Regional Office for South-East Asia and the All India Institute of Medical Sciences in New Delhi, India from 29–30 September 2014.

Participants from 10 of the 11 Member States of the Region attended the workshop. Representatives from national iodine deficiency disorders (IDD) control and prevention programmes, experts in public health nutrition, noncommunicable diseases, communication sciences, endocrinology, food technology and biochemistry, national focal points for noncommunicable diseases surveillance, and academia were present.

The general objective of the workshop was to strengthen an integrated approach for sodium reduction and salt iodization programmes in Member States of the Region. The specific objectives included reviewing the current sodium reduction and salt iodization strategies in Member States of the Region, providing training to the participants in standardized approaches for dietary estimation of salt/sodium, urinary iodine estimation and producing draft action plans at country level to assess sodium intake. The workshop would enable participants from Member States to obtain information on dietary salt reduction while maintaining optimum iodization of salt, knowledge and skills in assessing salt intake and establish the methods in their respective countries.

The meeting was inaugurated by Dr Sangay Thinley, Director, Department of Family Health and Research, WHO Regional Office for South-East Asia, who wished the participants of the workshop success in

their endeavours. Dr Sangay Thinley also delivered a message on behalf of Dr Poonam Khetrapal Singh, WHO Regional Director for South-East Asia.

In her message, Dr Singh stated that the increasing prevalence of noncommunicable diseases in the South-East Asia Region is an escalating problem for the health sector as well as other sectors. Reducing dietary salt by 30% from present levels of intake by 2025 has been recommended by the recent United Nations Summit to prevent noncommunicable diseases, particularly cardiovascular disease. Excess dietary salt increases blood pressure, contributing to approximately 30% of hypertension and is associated with other diseases including renal stones and osteoporosis. The global burden of high blood pressure is responsible for 50% of cases of cardiovascular disease. WHO recommends that sodium consumption be reduced to < 2 g/day in adults and < 2 g/day in children relative to their age. The World Health Organization is promoting reduction in salt intake to 5 g/day as a cost-effective strategy to reduce hypertension and the overall burden of noncommunicable diseases, while, at the same time, promoting universal iodization of edible salt for the prevention and control of IDD. Reduction in dietary salt intake and optimization of salt iodization can be synergized by promoting their commonalities and complementarities. The importance of salt reduction as a low-cost effective strategy in reducing the burden of cardiovascular disease cannot be over emphasized. At the same time, the successes of the IDD control programmes, one of the most successful public health strategies, should be continued. This workshop, which will deliberate on strategies for reduction of salt intake in this Region, would provide future direction for all participating countries.

Dr M.C. Mishra, Director, All India Institute of Medical Sciences welcomed the participants and thanked the WHO Regional Office for South-East Asia for organizing this meeting as an appropriate response to the emerging problems of hypertension and cardiovascular diseases while also highlighting the importance of ensuring adequate iodine intake in the population. He stated that salt intake is significantly associated with increased risk of stroke and other cardiovascular diseases (CVD) and evidence supports the reduction of salt as a population-level strategy for reduction of CVD. In most parts of South-East Asia, adult salt intake levels are as high as 12 g per day. Reducing salt intake to 5 g/day at population level could prevent around a quarter million deaths by strokes and three million deaths from other CVD. He wished the participants success in their deliberations and a productive meeting, thereby contributing to an improved scientific understanding and initiating harmonized action for

reducing sodium intake while maintaining salt iodization. The All India Institute of Medical Sciences would be willing to provide technical assistance to the Member States in the estimation of 24-hour dietary intake of sodium in urine, urinary iodine excretion and iodine content of salt.

Professor Michael Zimmermann was nominated as the Chairperson and Dr Angela de Silva as the Rapporteur for the workshop.

The objectives and mechanics of the workshop and expected outcomes were presented by Dr Kunal Bagchi, Regional Adviser for Nutrition and Food Safety, WHO Regional Office for South-East Asia.

The list of participants and the programme are respectively given in Annexes 1 & 2.

2

Technical report

Importance of population salt reduction

Dr Renu Garg, Regional Adviser, Noncommunicable Diseases, WHO Regional Office for South-East Asia

Deaths from NCD in countries of the South-East Asia Region are 8.5 million per year, with 50% being premature deaths. The New Delhi Declaration on High Blood Pressure (2013) was adopted by the health ministers in recognition of the fact that while noncommunicable diseases account for 55% of the 14.5 million total deaths in the Region, cardiovascular diseases alone account for 25% of all deaths (3.6 million) with high economic cost. Approximately a third of the population in the Region suffer from high blood pressure and reduction in dietary salt intake by 30% has been advocated by WHO as a low-cost, best buy strategy for a 25% reduction in NCDs by 2025.

The importance of dietary salt reduction is also highlighted in the declaration of the UN General Assembly which promotes cost-effective interventions to reduce salt intake. The dietary salt intake in the Region is high, as shown by different types of surveys and ranges from 10–17g of salt/day. Some countries, notably Finland and the United Kingdom have successfully reduced salt intake in their populations through various strategies within a period of 10–12 years. Optimizing salt reduction and salt iodization are both important strategies that need to be implemented in a complementary manner in the South-East Asia Region. Common areas of work for salt reduction and salt iodization include policy development and implementation, monitoring and evaluation of programmes, communication and advocacy, surveillance of salt and iodine intake as well as joint strategies and shared forums with the food industry.

Aligning and harmonizing salt iodization with salt reduction: technical and operational issues

Professor Michael Zimmerman, Executive Director, International Council for the Control of Iodine Deficiency Disorders Global Network

Iodine deficiency disorders, the most common cause of mental retardation globally, can impact humans throughout the lifecycle. Iodization of salt is one of the most cost-effective public health interventions where only an investment of 5–10 cents/year per person is needed to prevent a host of deficiency disorders. Over two decades, iodization of salt has reduced the prevalence of IDD across countries, with only 31 countries remaining iodine-deficient compared to 131 countries in 1993. At present, 70% households worldwide have access to adequately iodized salt.

Salt is the preferred vehicle for iodization, since it is consumed by everyone, has stable consumption rates throughout the year. Addition of iodine does not affect the taste or colour of salt, importation/production is often limited to a few producers. Further, iodization technology is easy to implement and readily available at a reasonable cost and the quality of iodized salt can be easily monitored.

Dietary sodium reduction is a public health priority, but strategies should be in synergy with efforts and progression made so far by salt iodization. WHO has emphasized the compatibility and synergy of salt reduction and salt iodization. No evidence to date indicates that salt iodization increases salt consumption or impedes reduction in salt intake. Country experiences have shown that salt iodization can be effective over a range of salt intakes from 6–15 g/day. Considering present levels of salt intake throughout the world, if salt reduction targets are achieved, a 50–100% reduction in salt intake would occur, and this may require upward titration of iodine concentrations in salt. Though, national programmes should ideally be able to titrate iodization levels as salt intakes rise or fall, the impact on iodine nutrition will vary, be country- and context-specific and depend on factors such as baseline salt intakes, extent of reduction and the main points of reduction, i.e. the relative contribution of household vs. food industry and contribution of 'hidden' dietary iodine sources (e.g., milk, groundwater).

The example of Croatia was provided, where true universal salt iodization has been achieved based on an estimated per capita salt intake of 10 g and all salt (food industry and household) is iodized at 25 ppm to provide 250 μg/day of iodine. If salt intakes fall to 5 g/day, salt iodization could be increased to 50 ppm without technical or sensory barriers to ensure similar provision level of iodine. If iodine levels are titrated up as salt intakes fall, regular monitoring is essential at a national level to assess iodine intakes of populations as salt reduction efforts go forward.

Successful strategies for the reduction of dietary sodium/salt intake in populations

Angela de Silva, Senior Lecturer, University of Colombo, Sri Lanka

Salt reduction in populations has been achieved in Finland and the United Kingdom through well-designed and successfully implemented strategies. The keys to success in these programmes were the strong commitment by governments and other stakeholders and the multisectoral approaches adopted by these countries. The UK programme that achieved 15% reduction in 24-h urinary sodium over seven years from 9.5 to 8.1 g salt per day, ($P<0.05$.) has several components which could serve as models for countries in the South-East Asia Region. The key strategies of the programme include strong leadership, policies and commitment, availability of population data regarding dietary salt intake (DSI) and common sources of dietary salt. The setting of progressively lower salt targets for different categories of food within a given time-frame for voluntary adoption by industry, technological support for reformulation of food products, food nutrition labelling, promoting consumer awareness and monitoring progress by frequent surveys were other successful interventions.

While overall, these strategies would hold true for Member States in the Region, the prioritization of interventions and the modes of implementation would differ, since salt reduction strategies in developing countries are yet in their infancy. Promotion and/or adoption of strong policies by countries, identifying the baseline salt intake in the population and main sources of dietary salt are fundamental to successful programmes as will be the participation of all relevant sectors, within and outside national governments. In the Member States of the Region, approximately 70% of intake is from salt added during cooking or at the table and reducing salt in

processed food, though helpful, would have little impact. Therefore, for the South-East Asia Region, public education regarding adverse effects of excess salt using a multisectoral approach would be the key strategy. Monitoring and evaluation of programmes; regulating salt content of processed and convenience foods and mandatory food nutrient labelling by multinationals; assisting small local companies with product reformulation technology and assessing nutritional composition of food products are some of the successful interventions that could be implemented. The importance of street foods in contributing to salt intake in Member States of the Region must not be overlooked and innovative methods are needed to address this sector. Finally, the goals of reduction of DSI while promoting intake of iodized salt needs coordinated efforts among all stakeholders.

Using strategic communication to change health and nutrition behaviours

Dr M Mosquera, Chief, Communication for Development, UNICEF, India

Since behaviours of target groups are influenced by many individuals and/or institutions, promoting behaviour change needs focus on multiple stakeholders. The Ministry of Health & Family Welfare, Government of India developed a strategic approach to Reproductive, Maternal, Newborn, Child and Adolescent Health (RMNCH+A) which also contains an integrated, evidence-based behaviour change approach. Evidence from this programme could be used in improving salt-related behaviours in the population. The key principles of mass media outreach, partnership strategy / mobilization, capacity development and social and behaviour change communication should be addressed. Building communication strategies using evidence-based information on people's behaviours, perceptions, influence of positive deviants, individual, household, community and service delivery factors that may facilitate or constrain demands and triggers, motivators and communication mechanisms would be more likely to lead to significant behaviour change. A multisectoral advocacy approach, audience segmentation based on income, habits and risk, using multiple communication channels regarding optimizing the use of iodized salt while reducing sodium intake and targeting decision-makers of households are other possible communication approaches.

3

Role of stakeholders

Moderators: J Hyun Rah (UNICEF, India) and R. Shankar, (GAIN)

Participants: Deepika Chaudhery, Nunik Kusumwardinee, Visith Chavasit

Deepika Chaudhery (Micronutrient Initiative)

Marked progress has been achieved in salt iodization across the Region with the proportion of households consuming adequately iodized salt (>=15 ppm) increasing significantly in most countries. The Micronutrient Initiative has used multiple strategies to optimize salt iodization. The promotion of low salt consumption requires an increase in iodization levels which will need to be supported by modifying salt iodization standards, monitoring and legislation frameworks/guidelines and investing in capacity to support such modifications both at processor and enforcement levels. Strong communication messages will be needed on reasons for modifications as well as highlighting the health benefits. All stakeholders would need to be on board to create an enabling environment in terms of regulations, public education and promotion of low salt products.

Visith Chavasit (Mahidol University)

Thailand's experience in promoting low sodium intake has had some successes and failures. The "traffic light system" adopted for promoting low-salt products was not effective due to an inability to develop relevant products and the low consumer demand. The pre-judged system, with healthy choice labelling for processed food, using a cut-off score system has been proposed as more appropriate and will be implemented by late

2014. Currently, the few low-salt products in the market are only used by a select group of consumers and for export purposes. Therefore, behaviour changes need to be promoted through nutrition education for consumers and industry. Development of low-sodium seasoning sauces and seasoning powders for routine preparation of street and restaurant foods and home-cooking is another area that needs attention. For Thailand's population, if salt consumption per capita decreases to the recommended 5 g/day (2000 mg of sodium/d), salt iodization levels would need to be increased by approximately 59%.

Nunik Kusumwardinee (Indonesia)

Indonesia has a policy and legislation on salt and has implemented some salt reduction strategies. Particular foods in the local diet that are high in salt have been identified through a dietary survey and monosodium glutamate is identified as the highest contributor to sodium in the diet (80%). Indonesia has adequate evidence that, their population, the food most associated with NCD are seasoning products. Multisectoral support is being established to implement salt reduction. Indonesian initiatives for promoting reduction of NCD include mandatory food labelling and warning messages regarding salt on food labels. Indonesia also faces challenges in implementation of its salt iodization programme. Universal salt iodization has not yet been achieved and programme gaps exist. There are also challenges in integrating the two programmes; low-salt intake and simultaneous promotion of intake of iodized salt.

The following is a summary of the panel discussion:

- The two strategies; reduction of dietary salt and promoting intake of iodized salt are compatible, but are at different stages of maturity in terms of implementation in Member States of the Region. The salt iodization programme has been implemented for over three decades while salt reduction is early in the programme cycle. Therefore, methods of harmonizing these two need to be examined.
- Currently, strategies and operational programmes for reducing DSI are limited in most countries of the Region and need to be moved forward rapidly.
- The cost implications of increasing iodization levels if DSI levels decrease over time need to be taken into consideration by countries and by donors.

- The salt industry, while being willing partners in salt iodization programmes, should also be motivated to promote becoming active stakeholders in salt reduction activities.
- Approaches for optimizing and harmonizing reduction in salt intake and salt iodization include promoting government-level advocacy on policies and legislation, capacity-building of technical resources, knowledge management on salt intake in populations and consumption patterns, involvement of civil society, academia and industry.
- Multiple health promotion strategies would be needed in optimizing and harmonizing reduction in salt intake and salt iodization.

4

Laboratory assessment methodologies

Assessing dietary sodium intake in populations

Umesh Kapil and Lakhsmy Ramakrishnan

Sodium is an essential nutrient required for a multitude of physiological functions including maintenance of cellular homeostasis, transmission of nerve impulse and normal cell functions. It is the main component of common salt, which is made up of 60% chloride and 40% sodium. The minimum daily dietary requirement is estimated to be 200–500 mg.

The majority of ingested sodium (~ 95%) is excreted through urine within 24 hours. The remainder (5%) is excreted through sweat, saliva and gastrointestinal secretions. The gold standard method of sodium assessment is 24-hour urinary sodium which captures more than 90% of sodium ingested. After collection of urine, urinary sodium can be measured using an automated electrolyte analyzer based on the direct ion selective electrode (ISE) method.

(For detailed methodology please refer to ***Annex 3***)

Assessing dietary sodium intake (DSI) in the population: experiences from the field

Dr Sailesh Mohan, Researcher, Public Health Foundation of India

Methods of assessment of dietary sodium in populations are the measuring of dietary intake of sodium and the assessment of biomarkers. Dietary sodium assessment includes 24-hour food intake recall detailing food and beverage consumption over the last 24 hours and calculation of sodium intake. Food frequency questionnaires and three-seven day food diaries provide details on frequency of consumption of salt containing foods or food groups in a specified time period. Though frequently used in dietary sodium assessment, dietary methods face several inaccuracies. These include the paucity of food composition databases for many local foods, the non-assessment of salt added during cooking or at the table, variations in salt content of foods, portion size estimation errors, recall bias and problems in ensuring completeness of given dietary data. Dietary data collection methods, if rigorous, can be used for estimation of sodium intake but are best for identifying sources of salt in the population.

Urine assessment of sodium can be through the spot urine assessment method, timed urine collection method and the gold standard method, the assessment of sodium in a 24-hour urine collection. Experiences from the Public Health Foundation of India study on sodium intake indicates that 24-hour urinary sodium excretion is feasible with active engagement of participants and if collection is done in conjunction with another health-care delivery or assessment activity. Written, oral, telephonic reminders are necessary subjects, with clear instructions to participants, and feedback regarding test results is essential. Challenges include low priority/awareness regarding urinary sodium, logistic difficulties in collection, transport, storage, costs associated with sample collection and analysis and a high rate of attrition.

The spot urine method is less suitable due to poor correlation with the gold standard method. Therefore, use of this method requires further validation in the population of each country, particularly the diurnal variation or the variation in sodium excretion following the salt content in the last meal prior to urine collection. However, it can be useful in repeated measures to assess relative changes in urinary sodium. Overnight urine collection has been proposed as a low-burden alternative to 24-hour collections and is preferred over spot urine samples, but does not reach the accuracy of 24-hour collections.

Urinary iodine assessment

Dr Umesh Kapil, Professor, Gastroenterology and Human Nutrition Unit and Dr Lakshmy Ramakrishnan, Professor of Cardiac Biochemistry, AIIMS, New Delhi

Urinary iodine assessment is a well-accepted, cost-efficient and easily obtainable indicator for iodine status. Since the majority of iodine absorbed by the body is excreted in the urine, it is considered a sensitive marker of current iodine intake and can reflect recent changes in iodine status. Although an individual's urinary iodine concentration can vary daily, or even within the same day, these variations tend to even out within populations, providing a useful measure of the iodine status of populations. Because urinary iodine values tend not to be normally distributed, the median is the preferred measure of central tendency, and percentiles, rather than standard deviations, are most commonly used to describe the distribution of data.

The method of urinary iodine estimation is based on the following principle: urine is digested with chloric acid under mild conditions and iodine is determined manually by its catalytic role in the reduction of ceric ammonium sulfate in the presence of arsenious acid. As the reduction proceeds, the intensity of colour decreases and can be readily measured in a spectrophotometer at 420 nm. This method is fast and inexpensive, and the digestion is less harsh than some other methods

(For detailed methodology please refer to ***Annex 4***)

Iodine estimation in salt

Suvabrata Dey, Pawan Kumar Tanwar and G. Mariappan

The Food Safety & Standards Act, 2006 states that iodine content of edible salt should not be less than 30 ppm at the production end and 15 ppm at consumer level. Iodized salt loses its iodine content due to moisture and heat, occurring mainly during transportation and therefore, it is essential to monitor the amount of iodine in salt. Iodine estimation in salt s is done by a quantitative method called the Iodometric Titration which estimates iodine content in iodized salt. Free iodine (I2) reacts with sodium thiosulphate solution as follows:

$2Na_2S_2O_3$	+	I_2	=	2NaI	+	$Na_2S_4O_6$
Sodium thiosulphate		Iodine		Sodium iodide		Sodium tetrathionate

For detailed methodology please refer to ***Annex 5***.

5

Conclusions and recommendations

Conclusions

(1) The reduction of salt intake to 5 g/day is an essential strategy to reduce complications associated with cardiovascular disease.

(2) Most Member States in the South-East Asia Region are at present lacking in strategies to reduce dietary salt consumption, while almost all countries have salt iodization programmes to control IDD.

(3) The twin goals of optimizing dietary sodium reduction and salt iodization are compatible and share commonalities and synergies. Reducing sodium intake should not jeopardize delivery of iodine to populations through salt iodization, as long as levels of iodine in salt are adjusted based on regular monitoring. Joint monitoring with existing iodine monitoring systems could facilitate joint tracking and monitoring in a cost-effective manner. Development of a shared infrastructure for implementation of salt reduction and salt iodization programmes is essential to the success of both activities.

(4) The two programmes are at different stages of maturity in their programme cycles; salt iodization programmes have been in place for over two decades while dietary salt reduction

programmes are relatively new. Therefore, knowledge and lessons learned in salt iodization could enhance delivery of salt reduction programmes and cooperation between the two will ensure optimization of both.

(5) The focus and initial step of dietary salt reduction programmes in the Region should be on educating consumers through a comprehensive public health strategy, as discretionary salt is the main source of salt in the diet.

(6) Achieving dietary salt reduction needs multisectoral efforts and cooperation among all stakeholders including health, education, science and technology, trade and industry sectors as well as food manufacturers and producers.

(7) Food manufacturers, especially local-level small-scale producers may need extensive technical assistance in formulating of new products, to ensure success of salt reduction programmes.

(8) The lack of consistent and country-level data on DSI as well as significant food sources contributing to salt intake are serious drawbacks in implementation of strategies to reduce salt intake. This should be corrected and in concurrence with public education on salt reduction to avoid delays in promoting reduction of salt intake.

(9) The gold standard for DSI, is the 24-hour urine sodium assessment method. Other biomarker methods such as spot urine testing and dietary intake data yield inaccurate results. Dietary data collection is best utilized to identify food sources of salt and dietary patterns of populations. Large scale 24-hour urinary sodium assessments are feasible as shown in a recent study done in India. Urinary creatinine can be measured as an indicator of the completeness of the 24-hour urine collection.

(10) For the future, the feasibility of potential integration of dietary salt intake assessments with national health surveys, demographic and health surveys and NCD risk factor surveys (STEPS) need to be evaluated.

(11) Multiple strategies are needed to reduce dietary salt consumption by populations. Identification of definitive actions and time lines to achieve salt reduction targets and clear, specific

messages which harmonize dietary salt reduction along with promoting usage of iodized salt will improve the efficacy of both programmes.

(12) Creating an enabling environment for reduction of dietary salt needs to focus on the following: Enhancing political commitment and dialogue for dietary salt reduction strategies in Member States, educating consumers, regulating and assisting industry to reduce salt in products, with separate targeting of multinationals and large national companies, small-to medium-level producers in formulation of products and street food vendors, thus increasing the availability of low-salt products.

Recommendations

- All Member States in the South-East Asia Region need to develop policies and strong legislation to regulate the reduction of DSI.
- A national-level committee should be set up to monitor and regulate dietary salt reduction and salt iodization programmes and ensure cooperation and safeguard optimization of both. Salt reduction and salt iodization optimization should be planned prior to the initiation of salt reduction programmes.
- Dietary surveys are needed in Member States to identify sources of high salt in the diet of populations.
- Baseline values of DSI should be established at country level by the '24-hour urine' method in different population groups.
- Public education and behaviour change communication regarding salt reduction is the main best buy strategy that should be implemented across all the Member States. A combined approach should be taken to achieve both salt reduction and promoting use of only iodized salt. Therefore, public health communications on dietary salt reduction should be clear and simple and not contradict or confuse consumers regarding consumption of iodized salt.
- Capacity-building of health workers and other sectoral human resources should be enhanced with regard to promoting interventions to reduce DSI.

- Iodine content in salt should be adjusted based on regular monitoring of both salt consumption and assessment of urinary iodine to minimize problems that may ensue with reduction of dietary salt and delivery of iodine to populations through salt iodization.
- Further research into more practical, low-cost field-based methodologies for DSI assessment at population level should be promoted.

Annex 1

Agenda

(1) Inaugural session

(2) Objectives and mechanics of the workshop

(3) Public health implications of reduced salt intake by population

(4) Aligning and harmonizing current salt iodization programmes with modified salt reduction strategies – technical and operational issues

(5) Monitoring of national IDD prevention and control programmes with new recommended levels of salt iodization.

(6) Assessing dietary sodium intake in population

(7) Salt iodization and reduced dietary salt intake: successful scenarios and what may work in the countries of South-East Asia

(8) Commercial implications of reduced salt consumption

(9) Role of stakeholders, including the private sector, in developing an effective public advocacy and awareness campaign

(10) Developing national advocacy and awareness programme for optimizing salt and iodine intake at the population level

(11) Conclusions and recommendations

Annex 2

List of participants

Bangladesh

Md Al Amin
Deputy Chief (DS)
GNSP Unit
Ministry of Health & Family Welfare
Dhaka

Ms Momena Shirin
Food Chemist
IPH
Dhaka

Bhutan

Ms Karma Doma
Senior Programme Officer
DPR Programme
Department of Public Health
Ministry of Health
Thimphu

Ms Kezang Meto
Nutritionist
Jigme Dorji Wangchuk National Referral Hospital
Thimphu

India

Dr G S Toteja
Scientist `G' & Head Nutrition
Indian Council of Medical Research (ICMR)
New Delhi

Dr Devesh Gupta
Addl DDG
National Iodine Deficiency Programme
Directorate General of Health Services
Ministry of Health and Family Welfare
Government of India
New Delhi

Dr Sila Deb
Deputy Commissioner (CH)
Ministry of Health and Family Welfare
Government of India
New Delhi

Indonesia

Dr Lily Banonah
Head of Division of Heart Disease Control
Directorate of Non Communicable Disease
Ministry of Health
Jakarta

Ms Yunimar Usman
Head of Section of Evaluation
Division of Micronutrient
Directorate of Nutrition Communicable Disease
Ministry of Health
Jakarta

Maldives

Ms Fathimath Thohira
Public Health Programme Manager
Health Protection Agency
Malé

Mr Abdul Latheef
Senior Laboratory Technologist
Health Promotion Agency
Malé

Myanmar

Dr Htin Lin (Mr)
Deputy Director (Nutrition)
Department of Health
Naypyitaw

Dr Khaing Khaing Phyu (Ms)
Team Leader (Nutrition)
Lashio
Shan State

Nepal

Mr Raj Kumar Pokhrel
Chief District Health Office
Illam

Mr Dayaram Neupane
Public Health Officer
Department of Health Services

Sri Lanka

Mr Ranbanda Jayawardana Mudiyanselage
Food & Drug Inspector
Medical Research Institute
Colombo

Mr Thilakaratne Haputhanthirige
Assistant Director
Nutrition Division
Narahenpita

Thailand

Mrs Supawan Manosoontorn
Public Health Technical Officer
Senior Professional Level
Bureau of Non-Communicable Disease
Department of Disease Control
Ministry of Public Health
Nonthaburi

Dr Saipin Chotivichien
Medical Officer
Senior Professional Level
Department of Health
Ministry of Public Health
Nonthaburi

Timor-Leste

Dr Epifania Deolinda Marques
Micronutrient Officer
Nutrition Department
Ministry of Health
Democratic Republic of Timor-Leste
Dili

Dr Liliana dos Santos Varela
Surveillance Department
Ministry of Health
Democratic Republic of Timor-Leste
Dili

Temporary advisers

Dr Umesh Kapil
Professor
Gastroenterology and Human Nutrition Unit
AIIMS
New Delhi
India

Dr Lakshmy Ramakrishnan
Professor
Cardiac Biochemistry
AIIMS
New Delhi
India

Dr Sailesh Mohan
Researcher
Public Health Foundation of India
New Delhi
India

Dr Nunik Kusumawardani
Researcher
National Institute of Health Research and Development for Diseases Control
Jakarta
Indonesia

Dr Angela De Silva
Nutrition Specialist
Senior Lecturer,
Department of Physiology,
Faculty of Medicine,
University of Colombo
Sri Lanka

Dr Visith Chavasit
Director
Institute of Nutrition – Mahidol University
Bangkok
Thailand

Dr Michael Zimmermann
Executive Secretary
International Council for the Control of Iodine Deficiency Disorders (ICCIDD)
Zurich
Switzerland

UN and other agencies

Dr Jee Hyun Rah
Nutrition Specialist
Child Development and Nutrition
United Nations Children's Fund (UNICEF)
India Country Office
New Delhi
India

Dr Mario Mosquera
Chief
Communication for Development (C4D)
United Nations Children's Fund (UNICEF)
India Country Office
New Delhi
India

Dr Deepika Nayar Chaudhery
Deputy Regional Director, Asia
Micronutrient Initiative (MI)
New Delhi
India

Dr Suvabrata Dey
National Programme Manager
Salt Iodization
Micronutrient Initiative (MI)
New Delhi
India

Dr Rajan Sankar
Country Manager & Senior Advisor
South Asia Global Alliance for Improved Nutrition (GAIN)
New Delhi
India

WHO Regional Office for South-East Asia, New Delhi, India

Dr Sangay Thinley
Director
Department of Family Health and Research

Dr Kunal Bagchi
Regional Adviser
Nutrition and Food Safety (NFS)

Dr Renu Garg
Regional Adviser
Noncommunicable Diseases (NCD)

Annex 3

Assessing dietary sodium intake in populations

Standard operating procedure (SOP) for estimation of dietary intake of sodium (DIS) In 24 Hour urine using electrolyte analyser

Estimation of dietary intake of sodium (DIS) in 24 hours urine on electrolyte analyser

A. Principle

The electrolyte analyser has different electrodes, specific for different ions of interest. Each electrode has an ion selective membrane (for example for sodium) that undergoes a specific reaction with the corresponding ion (sodium) contained in the sample being analysed. The membrane is an ion exchanger reacting to the electric charge of the ion causing a change in the membrane potential or the measuring voltage, which is built up in the film between the sample and the membrane. A difference in sodium ion concentration between the sodium solution inside the electrode and the sample causes an electrochemical potential to form across the membrane of the active electrode. The potential is conducted by the electrode to an amplifier, and is compared with the potential of a reference electrode. The sodium ion concentration measured is expressed in terms of mmol/L or mEq/L.

B. Equipment and materials

(1) Electrolyte analyser – automated microprocessor controlled analytic instrument based on ion selective electrode (ISE) technology

(2) Reagent pack for calibration

(3) Waste storage chamber for collecting waste

(4) Urine diluent

(5) Sodium (Na+) conditioner

(6) Quality control (QC) solution (provided by the manufacturer of electrolyte analyser).

(7) Urine-based internal QC solution: The controls come in the lyophilized form (freeze-dried) for enhanced stability. 100% human urine-based control should be used. Reconstituted stability after reconstituting urine control is generally five days at 2–8 °C or 14 days at -20 °C.

(8) Daily cleaning solution

(9) Weekly cleaning solution

(10) Auto pipette 200–1000 µl with pipette tips

(11) Eppendorf tubes (2 ml) for sample dilution

C. Methodology

The methodology will vary with different electrolyte analysers. The method described here is for performing sodium analysis in electrolyte analyser from Caertium

Step 1: Sample Preparation

(1) Urine sample, if stored at 4 °C or -20 °C should be kept to reach room temperature.

(2) The aliquot of urine should be mixed thoroughly to ensure homogeneity.

(3) Aspirate 250 µl of urine into a 2 ml tube using micropipette. Add 250 µl of urine diluent into the aspirate.

(4) Mix properly by inverting 5-10 times.

STEP 2: Installation of the reagent pack and start up of the instrument

(1) Position the reagent pack into the groove of the instrument.

(2) Turn on the power and boot up the instrument.

(3) The instrument carries out self-test.

(4) After the self-test, the instrument carries out a self-calibration at the end of which the slope of the electrodes will be displayed

on the screen and also printed out. Examine if the slope is in normal range (should be between 45–50 mV for sodium). 'OK' is displayed if the values are between 45–50 mV. Otherwise recalibration after cleaning the electrode would be required.

(5) After the calibration the main menu is displayed

Step 3: Running the quality check

A daily quality check should be done

(1) Press the tab 'service' in the main menu to display the service menu and then press the tab 'QC' to enter into measurement menu.

(2) Present the quality control solution provided with the instrument under the sample probe and press the tab 'aspirate', the result will be displayed and printed in 60 seconds.

(3) This value should be within the range specified on the vial of the quality control. For example for sodium, the value given on the vial may be 145±2 mmol/L. So, if the value of QC is between 143–147 mmol/L the test can go ahead to the next step.

(4) When more than 5 QC results are available, a statistical report can be obtained to see the trend.

(5) Press the tab 'stat' on the QC measurement menu to obtain mean and standard deviation of QC values.

Step 4: Preparation of work list for running urine samples

(1) A work list should be prepared if more than one sample is being run.

(2) Press the tab 'W. list' to enter into input number programme. Press the tab 'U/L' to change the mode of measurement to 'urine'. The operator can enter the sample number and the patient ID manually to create a programme for the number of samples to be analysed.

Step 5: Testing of urine control

(1) Press the tab 'sample' to enter into the sample measurement menu.

(2) Present the diluted urine control (prepared as mentioned in step 1) under the sample probe and press the tab 'aspirate'. The sample will be aspirated into the system.

(3) Remove the sample when the screen indicates 'remove sample' with a beep sound.

(4) The result will be displayed within 55 seconds and printed out. Repeat the process to measure the remaining samples.

(5) If the urine quality control value is within the range specified for the control, the testing can proceed to the next step.

Step 6: Testing of urine sample

(1) Press the tab 'sample' to enter into the sample measurement menu.

(2) Present the diluted urine sample (prepared as mentioned in step 1) under the sample probe and press the tab 'aspirate'. The sample will be aspirated into the system.

(3) Remove the sample when the screen shows 'remove sample' with a beep sound.

(4) The result will be displayed within 55 seconds and printed out. Repeat the process to measure the remaining samples.

Calculation:

For each individual, the 24-hours sodium excretion value (mmol/day) is calculated as the concentration of sodium in the urine (mmol/L) multiplied by the total urinary volume (L/day).

D. Quality assurance

External Quality Assessment (EQA):

- External quality assessment permits comparison of results between laboratories measuring the urinary sodium.
- EQA is a retrospective process of assessment of performance, particularly of inaccuracy or bias with respect to mean values.
- EQA programmes for sodium are available through different sources.

Example:

(1) Bio Rad urine chemistry programme.

(2) Wales External Quality Assessment Scheme (WEQAS)

(Both EQC programmmes send 12 samples/year).

E. Maintenance of the electrolyte analyzer:

Daily maintenance

(1) Check the reagent residual volume and replace when needed.

(2) Run the daily maintenance solution at the end of analysis each day.

Weekly maintenance

(1) Check the voltage of each electrode. Replace the reference filling solution in electrode or the reference membrane, if necessary. Refill the filling solution in the electrode if the volume is less than 2/3 of the total volume.

(2) If there is salty crystal on the electrode, clean using a damp tampon.

(3) Run the cleaning programme in the service menu once a week if measuring > 25 samples/day. If < 20 samples are measured each day, the cleaning programme could be run once in 2–3 weeks.

(4) Run "Na adjust" programme if the slope of Na electrode is less than 45.

For further problems the service engineer should be contacted.

Standard Operating Procedure (SOP) For estimation of urinary creatinine by Jaffe's method using a semi-autoanalyser

A. Principle

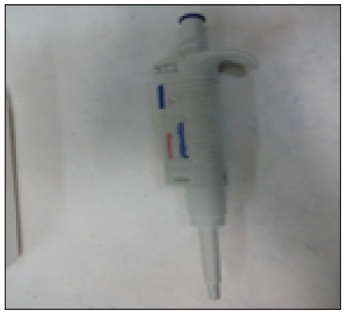
Creatinine forms a coloured orange-red complex in an alkaline picrate solution. The difference in absorbance at fixed times during conversion is proportional to the concentration of creatinine in the sample.

B. Equipment and materials

(1) Analyser: Fully automated or semi-automated: The method described below is using a semi-autoanalyzer:

(2) Auto pipette 200–1000 ul with pipette tips

(3) 2 ml Eppendorf tube for urine dilution



(4) Internal quality control (urine-based) will have a mean value and range specified

(5) Reagents : Reagent R1 (Sodium hydroxide)

Reagent R2 (Picric acid)

(6) Creatinine standard: 2mg/dl (177 μmol/L)

C. Methodology

Sample preparation

(1) Mix the urine sample to ensure homogeneity.

(2) Dilute urine 1:49 with distilled water. (10 µl of urine and add 490 µl of distilled water).

(3) Mix properly.

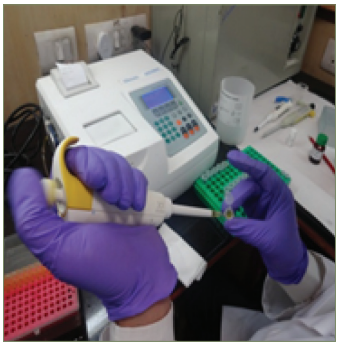
(4) Repeated freeze/ thaw of urine should be avoided.

Performing the test

(1) 5 ml test tubes should be labelled as S for standard, C for quality control and S1, S2, S3…….for urine samples and kept on a test rack

(2) Pipette 400 µl of the reagent 1 and 100 µl reagent 2 into the test tube labeled standard (S) , quality control (QC) and sample 1,2, respectively.

(3) Add 25 µl of standard into the tube labelled S, mix properly by inversion and aspirate into the semi-autoanalyser immediately. The wavelength of the autoanalyser should be set at 505 nm. The result will be displayed after 3 minutes.



(4) 25 µl of quality control is similarly added to the tube labelled C and proceed as given in step 3.

(5) The result of the quality control will be displayed on the screen. Verify that the value is within the range specified. If not, rerun the standard and quality control. Proceed to the next step only after obtaining the correct value.

(6) The samples are added sequentially one after the other to the reagent and measured as given in step 3.

(7) The creatinine value in mg/dl or µmol/L will be displayed on the screen.

Annex 4

Urinary iodine estimation

Standard Operating Procedure for estimation of iodine in urine by the colorimetric method after chloric acid digestion

(A) Principle

Urine is digested with chloric acid under mild conditions and iodine is determined manually by its catalytic role in the reduction of ceric ammonium sulfate in the presence of arsenious acid. As the reduction proceeds, the intensity of colour decreases and this can be readily measured in a spectrophotometer at 420 nm. The method is fast and inexpensive, and the digestion is less harsh than some other methods. This method can measure urinary iodine concentrations in the range of 0–150 μg/liter but can be extended further to cover a wider range of values.

(B) Equipment and materials

(1) Oven with fan exhaust

(2) Vented fume hood on oven for perchloric acid escape

(3) UV spectrophotometer

(4) Thermometer

(5) Timer (stop watch reliable to 5 second)

(6) Test tubes (15mm x 100mm)

(7) Funnel (56x100 mm)

(8) Reagent flasks and bottles

(9) Glass pipettes

(10) Micropipettes

(11) Whatman No 1 filter paper

(12) Analytical balance.

(C) Chemicals (analytical grade AR /GR)

(a) KClO3 (potassium chlorate)

(b) HClO4 (perchloric acid, 70%)

(c) As2O3 (arsenic trioxide)

(d) NaOH (sodium hydroxide)

(e) H2SO4 (sulfuric acid)

(f) Ce(NH4)4 (SO4)4 2H2O (ceric ammonium sulfate)

(g) KIO3 (potassium iodate)

(h) HCl (hydrochloric acid)

(i) Double distilled water (free of iodine and other contaminants).

(D) Preparation of reagents

(1) Chloric acid solution:

In a 2000 ml Erlenmeyer flask, 500 g potassium chlorate is dissolved in 910 ml hot double distilled water until the soluble state is achieved (normally a little amount remains undissolved). 375 ml of 70% perchloric acid is added drop wise (approx. 15 ml/min) while stirring constantly. This preparation should be carried out under a vented fume hood, as it produces toxic fumes. Subsequently, the solution is kept in a refrigerator overnight for better separation. The next day it is filtered through a filter paper, (Whatman No. 1) and stored in a refrigerator at 40C.

(2) Arsenious Acid Solution:

0.986 g arsenic trioxide is taken in a 1000 ml volumetric flask and is dissolved in 10 ml of 0.5 N hot sodium hydroxide. This solution is transferred into 750 ml chilled double-distilled water. Then 20 ml concentrated HCL and 39.6 ml conc. sulphuric acid (98%) is added drop-wise with constant mixing. The solution is stored in an amber coloured bottle at room temperature.

(The solution is stable for months).

(3) Sulphuric acid solution (3.5N H_2SO_4):

97 ml concentrated sulfuric acid (98%) is added drop-wise into 800 ml chilled double distilled water (should take care as this generates heat) and final volume is made up to 1 L with double-distilled water.

(4) Ceric ammonium sulfate solution:

48g ceric ammonium sulfate is dissolved in 1L of 3.5N H_2SO_4. This is stored in an amber-coloured bottle at room temperature. (The solution is stable for months).

(5) Stock iodine standard (1 mg/ml): 168.5 mg KIO_3 is dissolved in double-distilled water to make a final volume of 100 ml. This is stored in an amber-coloured bottle (The solution is stable for months).

(6) Dilute Iodine Standard (1 µg/ml): Take 100 µl of stock iodine standard and make up a volume to 100 ml with double-distilled water

(7) Working iodine standard: Do the following serial dilutions from diluted iodine standard (1 µg/ml) into volumetric flasks (10 ml) with double-distilled water (diluent). These dilutions are made freshly.

Quantity (ug/dl)	Dilution factors
5 ug	0.5 ml of 1 ug/ml standard + 9.5 ml diluent
10 ug	1.0 ml of 1 ug/ml standard + 9.0 ml diluent
15 ug	1.5 ml of 1 ug/ml standard + 8.5 ml diluent
20 ug	2.0 ml of 1 ug/ml standard + 8.0 ml diluent

(E) Methodology for testing

Step I.: Preparation of standard and samples

(1) The urine sample is shaken to evenly suspend any sediment.

(2) 250 ul of each urine sample is pipetted into a 15x100 mm test tube.

(3) Iodine standards are prepared from the 1 ug/ml stock iodine solution.

(4) The iodine standards corresponding to 0/5/10/15 and 20 ug/dl are prepared.

Step II. Digestion

(1) 750 µl of chloric acid solution is added to each tube (samples, blank, internal quality control sample, standards) and mixed gently.

(2) All tubes are placed in the oven at 110 ^{0}C–120 ^{0}C for 75 minutes (with a fume hood for the trapping of perchloric acid).

(3) Only minor volume changes would occur during heating. Some samples may be faintly yellow.

(4) All the tubes should be cooled at room temperature for 15 minutes. Then, the decreased volume is adjusted with double-distilled water to their original volume (1.0 ml) and vortexed.

Step III

3.5 ml of arsenious acid is added to each test tube and after mixing all test tubes are kept for 15 minutes at room temperature.

Step IV

350 µl of ceric ammonium sulfate solution is added at a fixed interval of time to each tube and quickly mixed with the help of a vortex. A stopwatch is used to keep a constant interval (30 seconds) between additions to successive tubes. At 20 minutes, after addition of ceric ammonium sulfate to the first tube, the reduction is read spectrophotometrically at 420 mm against the reagent blank at the same interval. Successive tubes should be arranged in a such a manner that the interval between the time of addition of ceric ammonium sulfate and the time of reading is exactly 20 minutes (for all samples, standards and blanks).

Step V: Calculation of results

The exact value of urine sample's iodine is calculated as follows.

(1) The average absorbance value for each set of reference standard, control and samples is calculated.

(2) A standard curve is constructed by plotting the mean absorbance obtained for each reference standard against its concentration ug/dl on linear graph paper, with absorbance on the vertical (Y) axis and concentration (ug/dl) on the horizontal (X) axis.

(F) Precautions:

(1) Since the digestion procedure has no specific end-point, it is essential to run blanks and iodine standards with each assay to allow for variations in heating time, etc.

(2) The exact temperature, heating time and cooling time can vary. However, within each assay, the interval between the time of addition of ceric ammonium sulfate and the time of the reading must be the same for all samples, standards, and blanks.

(3) In this procedure, it is convenient to run 60 sample tubes per assay of which five are standards (at concentrations of 0,5,10, 15 and 20 μg/dl).

(4) Perchloric acid fumes can be toxic and the complex generated may be harmful, particularly if allowed to dry in a ventilation system. The recommended method releases much less perchloric acid than other digestion methods.

(5) The exact time and temperature is not critical as long as all tubes are heated the same way.

(6) 1.68mg KIO3 contains 1 mg iodine. KIO3 is preferred over KI because it is more stable.

(7) Test tubes can be reused if they are carefully washed to eliminate any iodine contamination.

(8) Separate pipettes should be used for all the test tubes and also pipettes used for preparation of each standard solution should be kept separately and not be mixed with the general pool of glassware. They should be kept separately for all times to avoid contamination.

G: General instruction and precautions

Preparation of chronic acid for washing glassware

Saturated solution of $K_2 Cr_2 O_7$ (28 gm) is prepared in 500 ml of distilled water. Add 500 ml of technical/commercial grade conc. H_2SO_4 slowly (if solution of potassium dichromate is in chilled condition, heat evolved will be less). Discard chronic acid if it has turned green/light green.

(1) Dip the glass ware for 24 hours in chromic acid.

(2) Use gloves to take out glassware from chromic acid and then wash repeated by with tap water. Rinse twice with distilled water and finally, double-distilled water.

(3) Dry at 80–1000 °C in an oven.

H. Precaution to be taken during preparation of reagents and carrying out the assay

(1) Keep all the glassware and tips used for preparation of standards separately and wash them also separately.

I. Pooled sample:

Once the method is standardized, prepare the urine for internal quality assessment (use pooled sample, mixed properly, or collect approximately 250–300 ml from one individual). Analyse the sample 20–25 times with standard and blank in duplicate. Calculate mean and standard deviation (consult statistician/expert). The value of the sample should be between 5–15 μg/dl. If not, collect fresh sample of urine or dilute the sample with double-distilled water to get proper range. Store this sample in small aliquots of approximately 1.0 ml (100 to 150 aliquots) in a refrigerator (4–80 ^{0}C) and analyze one aliquot with every batch of unknown samples.

For analysis of the unknown samples, use the batch of 40 tubes. (Two tubes for blank, 4 standards (5, 10, 15, 20 g/dl), one internal quality assessment sample and once in three weeks one external quality assessment sample + remaining unknown samples).

The result of the internal quality assessment sample is used to draw the Levy - Jennings Plot.

Annex 5

Iodine estimation in salt

Laboratory procedure for iodine estimation of salt

Iodized salt may lose iodine due to moisture and heat during transportation. Therefore, it is essential to monitor the amount of iodine in salt by quantitative method (iodometry). The details of this procedure are as follows:

5.1 Principle and laboratory procedures for iodine estimation in salt

(I) Principle

The iodine content in iodated salt is estimated by a process called iodometric titration. Free iodine reacts with sodium thiosulphate solution as follows:

$2Na_2S_2O_3$	+ I_2	= 2NaI	+ $Na_2S_4O_6$
Sodium thiosulphate	Iodine	Sodium iodide	Sodium tetrathionate

(II) Equipment and chemicals

a) Equipment

(1) Laboratory balance for preparing reagents

(2) Beakers – 100 ml, 200 ml, 500 ml

(3) Glass bottles with stoppers for reagents:

1000 ml

250 ml

(4) Open pan balance for weighing salt samples

(5) Measuring cylinders with stopper 50 ml

(6) Wash bottle 500 ml

(7) Conical flasks with stopper 200 ml

(8) Glass or plastic funnel

(9) Auto dispensers

(10) Burette 10 ml auto zeros

b) *Chemicals*

(1) Sodium thiosulphate - $Na_2S_2O_3$, Analytical reagent grade (AR)

(2) Concentrated sulphuric acid – H_2SO_4, (AR)

(3) Potassium iodide – KI, (AR)

(4) Soluble chemical starch

(5) Boiled double-distilled water, pharmaceutical grade

The approximate cost of reagents would be Rs 1200, which would analyse 100 salt samples.

III) Preparation of reagents

(a) **Sodium thiosulphate ($Na_2S_2O_3$):** Dissolve 1.24 grams in 1 litre double-distilled water. Store the solution in a cool, dark place. Normality may change as time progresses. It is advisable to prepare a small quantity of 0.005 N $Na_2S_2O_3$ each day as required to avoid change of normality and storage problems.

(b) **2.N Sulphuric acid ($2H_2SO_4$):** To 90 ml double-distilled water, add 5.56 ml concentrated H_2SO_4 slowly. Add double-distilled water to make 100 ml. Store in a cool, dark place. The solution may be kept indefinitely.

Caution: To avoid violent and dangerous reaction always add acid to water, never water to acid.

(c) **Potassium iodide (KI, AR):** Dissolve 10 grams KI in 100 ml double-distilled water. Store in a cool, dark place. Properly stored, the solution may be kept for six months.

(d) **Saturated sodium chloride (NaCl):** To boiling double-distilled water, go on adding sodium chloride while stirring until no more of it dissolves. Cool the solution.

(e) **Soluble chemical starch:** Weigh 1 gram of soluble starch and dissolve in 10 ml double-distilled water. Add 90 ml of saturated sodium chloride solution to make it up to 100 ml. Add a pinch of sodium benzoate as a preservative.

(IV) Procedure

Weigh 10 grams of salt and put it in a stoppered conical flask. Add 50 ml of distilled water and dissolve the salt. Add 1 ml of 2N H_2SO_4 followed by 1 ml of 10% KI solution with the help of an automatic dispenser and close the flask with a stopper. If the iodine is present, the solution will turn yellow. Keep the flask in the dark (e.g. in a closed cupboard) for 10 minutes to avoid exposure to light. Remove the flask and titrate against 0.005N $Na_2S_2O_3$. During the titration, when the yellow colour becomes pale, add two drops of

the starch solution as an external indicator. The solution will become purple. Continue titration till the solution becomes colourless. Note the burette reading. To calculate the iodine content in parts per million (ppm), refer to Table 8.

Table 8: *Iodine content in parts per million (PPM)*

Burette reading	Parts per million (PPM)	Burette reading	Parts per million (PPM)
0.0	0.0	2.6	27.5
0.1	1.1	2.7	28.6
0.2	2.1	2.8	29.6
0.3	3.2	2.9	30.7
0.4	4.2	3.0	31.7
0.5	5.3	3.1	32.8
0.6	6.3	3.2	33.9
0.7	7.4	3.3	34.9
0.8	8.5	3.4	36.0
0.9	9.5	3.5	37.0
1.0	10.6	3.6	38.1
1.1	11.6	3.7	39.1
1.2	12.7	3.8	40.2
1.3	13.8	3.9	41.3
1.4	14.8	4.0	42.3
1.5	15.9	4.1	43.4
1.6	16.9	4.2	44.4
1.7	18.0	4.3	45.5
1.8	19.0	4.4	46.6
1.9	20.1	4.5	47.6
2.0	21.2	4.6	48.7
2.1	22.2	4.7	49.7
2.2	23.3	4.8	50.8
2.3	24.3	4.9	51.9

Burette reading	Parts per million (PPM)	Burette reading	Parts per million (PPM)
2.4	25.4	5.0	52.9
2.5	26.5	5.1	54.0
5.2	55.0	7.7	81.5
5.3	56.1	7.8	82.5
5.4	57.1	7.9	83.6
5.5	58.2	8.0	84.6
5.6	59.2	8.1	85.7
5.7	60.3	8.2	86.8
5.8	61.4	8.3	87.8
5.9	62.4	8.4	88.9
6.0	63.5	8.5	89.9
6.1	64.5	8.6	91.0
6.2	65.6	8.7	92.0
6.3	66.7	8.8	93.1
6.4	67.7	8.9	94.2
6.5	68.8	9.0	95.2
6.6	69.8	9.1	96.3
6.7	70.9	9.2	97.3
6.8	71.9	9.3	98.4
6.9	73.0	9.4	99.5
7.0	74.1	9.5	100.5
7.1	75.1	9.6	101.6
7.2	76.2	9.7	102.6
7.3	77.2	9.8	103.7
7.4	78.3	9.9	104.7
7.5	79.4	10.0	105.8
7.6	80.4		

5.3 Calculations

The table of iodine content as determined by the burette reading has been prepared based on the following:

(1) 1 ml of 0.005N $Na_2S_2O_3$ = 0.1058 mg of iodine.

(2) Thus, the burette reading X 0.1058 will give the amount of iodine in 10 gm of salt.

(3) To get the iodine value in parts per million, one has to multiply by 100 000 to either side

Gms of salt	I_2 in mg
10 X 100 000	0.1058 X 100 000

(4) To convert mg into gm, divide by 1000

Equation becomes:

Gms of salt (I0 00 000) = Burette reading X 0.1058 X 100

= Burette reading X 10.58

Thus, burette reading X 10.58 will give the iodine content in ppm.

5.4 Precautions

Adding sulphuric acid to a solution of iodated salt liberates iodine, which is titrated with sodium thiosulphate. Starch is used as an external indicator. Potassium iodide solution is added to keep the iodine in the dissolved state.

(1) The starch solution must be added near the end of the titration, when very little iodine is left and the solution has a faint-yellow colour. If starch is added earlier, the iodine starch complex becomes very strong and reacts too slowly with sodium thiosulphate, resulting in false high readings.

(2) The titration should be done in a comfortably cool room because iodine is volatile and the sensitivity of the starch indicator diminishes as the temperature rises.

(3) Potassium iodide (KI) is used because of the low solubility of iodine. The liberated iodine forms an unstable complex KI_3 with KI:

$$KI + I_2 = KI_{-3} \text{ and } I^- + I_2 = I_3$$

(4) As free iodine is used up in the reaction with thiosulphate, the equilibrium between I2 and I3 ions is disturbed and more iodine is dissolved in order to maintain the equilibrium.

(5) A few minutes should be allowed before titration, since the rate of reaction between I- ions and the oxidant is slow.

(6) The reaction mixture should be kept in the dark before titration because light accelerates a side reaction in which iodide ions are oxidized to iodine by atmospheric oxygen.

Annex 6

Country workplans

S.No	Country Name	Activities of DIS which are being undertaken	Actions which will be taken for undertaking DIS in the country after attending regional workshop	Assistance required for conducting DIS	Lab Facilities available for DIS estimation	Government	Development partners
1	BAN	No activities have been undertaken yet.	• Disseminate the message about "reduction of dietary intake of sodium" to the policy-makers and stake-holders. • Arrange ToT on "the danger of extra salt intake and iodized salt" at national, divisional, district and upzilla levels. • Arrange ToT on "the danger of extra salt intake and hypertension" for the medical officers (public health nutrition). To arrange training for health-care givers and health assistants at the field level to disseminate the message to people at the upzilla level. • Arrange a survey at district level for base-line data of urinary sodium level at population level. • Disseminate this data at central level. National Nutrition Services through Management Information System. Mainstreaming salt reduction activities with Cardiovascular Diseases Association. • More training can be arranged abroad for technology transfer. Sending medical technologist for training to India (AIIMS).	Arrangement of funds for development of laboratory facility. Funds for training and advocacy meetings. Establishment of laboratory.	• At central level, laboratory facilities are almost available. • Training is required for "medical technologist".	To convince the importance of advocacy meetings, training (ToT) and base-line survey.	To assist in funding and add logistic support for advocacy meeting, training (ToT) and base-line survey.

S.No	Country Name	Activities of DIS which are being undertaken	Actions which will be taken for undertaking DIS in the country after attending regional workshop	Assistance required for conducting DIS	Lab Facilities available for DIS estimation	Government	Development partners
2	BHU	• Step I & II (WHO) survey has been conducted in June 2014 for general population. • Urinary sodium and 24-hour food recall has been collected. • Bhutan food-based dietary guidelines have been developed which clearly state sodium intake should be less than 5gms/head/day. • Awareness campaign on healthy eating habits being carried out in schools, communities, and multimedia. • Training of health workers on prevention and control of NCD. • In every hospital, NCD clinics are conducted twice a week especially for NCD, patients and who would like to be screened for NCDs	• The study results of Step I & II needs to be presented to the national steering committee (NCD). • IEC on reduction of salt intake will be emphasized for the general public through (i) Posters/pamphlets (ii) Radio messages (iii) Talk show on TV • Collaborate with other relevant sectors on integration of DIS with IDD central programme. Low salt intake and sustaining IDD elimination.		• Laboratory facilities are available but used only for studies and not for other general purposes. • Capacity-building of laboratory personnel.	• Support of manpower • Development of rules or regulations on specific food labels regarding sodium content.	• Technical support. • Financial support.

S.No	Country Name	Activities of DIS which are being undertaken	Actions which will be taken for undertaking DIS in the country after attending regional workshop	Assistance required for conducting DIS	Lab Facilities available for DIS estimation	Government	Development partners
3	INO	• The 24-hour dietary intake of sodium has been analysed from the total diet study that was completed in 2014. • Integrate the iodine monitoring programme and the salt reduction program. • Disseminate the regulation on salt intake, nutrient labelling and health messages in food packaging. • Develop technical guidance.	• Analyse the dietary data to describe the sodium intake in the population by age groups, sex, urban-rural, economic/income quartile, education background. • Publish the results of the sodium intake study to stakeholders. • Plan to conduct the 24-hour sodium urine study in small population group. • Advocacy with related stake-holders pointed out the health message of "controlling the salt reduction initiatives into the iodized salt and health campaign". • Review the existing organizations and involving national IDD prevention and control activities with salt manufacturers associations. • Develop integrated national action plan and road map for salt reduction and iodized salt programme on: (i) use of iodized salt (ii) salt reduction (iii) supervision and monitoring (iv) multisectoral approach (private, government, NGOs).		Technical and financial assistance for updating the nutrition data base.	• Following-up the findings from DIS study and use as part of evidence based to support policy-making and decision-making process. • Collaboration and multisectoral coordination.	• Optimizing supports from partners or organizations such as WHO, UNICEF, GAIN, MI. • Improve collaboration with government sectors such as Ministries of industry, trade, food and drugs agency, and Home Affairs.

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4	MAV	• Last IDD survey data in 2002 (12 yrs). • No dietary intake of sodium data available in the country. • Currently, the country is working on development of multisectoral action plan on NCD. • NCD risk factor survey is being planned, therefore, data on sodium intake can be incorporated in this survey. • MICS 2 has some data on iodine status of a sample population.	• Lobby for policy-level support on the need for salt reduction to prevent NCD and thereby prevent premature deaths and to utilize the efforts. • Establish a technical working group on salt reduction, which includes all relevant technical experts and other stake-holders. • Establish a network to reduce NCD including salt reduction. • Intensify awareness activities being planned or ongoing about salt reduction and emphasize iodized salt use. • Integrate salt reduction efforts/ messages in other relevant programmes apart from NCD programme.	• Technical and financial support to assess capacity and strengthen IDD control and elimination. • Baseline survey on NCD risk factor including dietary salt intake. • Strengthening laboratory service.		• Health Protection Agency, MoH • Maldives Food and Drug Authority • Indira Gandhi Memorial Hospital.	• NGOs (Society for Health Education, Maldives Red Crescent, Maldivian Medical Association etc) • UNICEF • WHO • World Bank, etc.

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5	MMR	• Health education to public to reduce salt intake and risk of CVD. • Education about sodium rich foods, preservative methods and consumption habits. • Considering DIS assessment together with STEP survey or national food and nutritional survey.	• Advocacy: authorities that are needed to estimate DIS in country. • Meeting with related government sectors, institutions and organizations. • Plan and proposal for undertaking DIS in population. • Procure and collect instruments and materials and reagents. • Plan to train technicians and practice with standard procedures. • Sample collection and analysis for DIS in 24-hour urine. • Surveillance, evaluation and monitoring of DIS in population. • Linkage between baseline data of DIS and reduction of sodium intake due to intervention programme.		• Training of laboratory technicians for undertaking DIS in 24 hrs urine. • Resource allocation and procurement for necessary lab instruments and reagents.	• Advocacy to health authority and related sectors and departments. • Integrated plan for DIS assessment. • Recruitment of human resource.	• Collaboration for estimation of DIS in population. • Technical assistance for estimation of DIS. • Financial supports for estimation of DIS in population.

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6	NEP	• No significant activities currently on low sodium intake, no survey done on Na intake. • Nepal Micronutrient Survey done in 1998 – 13.8gms/per day • IDD status survey done in 2005 – UIE among SAL 190 mg/l, no new cases of goitre after 2005. • Plan for micronutrient survey and NDHS in 2015. • Iodized packed salt in hard to reach districts and areas where households consumption of iodized salt is low. • Salt sale report generated regularly through Salt Trading Corporation.	First phase • Advocacy to start planned micronutrient survey. • Comprehensive behaviour, change and communication for reduction of daily dietary intake of salt will be started in a district. • Activities will be: overview to HWS, CHWS, CH volunteers, Health mothers group, stakeholders (district politicians, media, and government line agencies during regular health programmes. • Regular messages on FM/radio • Reduction of salt intake education in regular school health programmes. Second phase • Food consumption survey (baseline) including per capita/day dietary intake of salt/sodium. • Generate population-based data of per capita/day dietary intake of salt/sodium in upcoming NDHS 2015. • Develop policies and strategies against the lifestyle related noncommunicable diseases and development of communication strategies and guideline to reduce dietary intake of sodium for the case study.	• Technical funding support for the food consumption survey including food base dietary intake of salt/sodium baseline survey. • Creating capacity to organize food consumption survey and food-base dietary intake of salt/sodium baseline survey. • Strengthening of district health laboratory (in the form of sentinel sites) to perform analysis and report dietary intake of salt/sodium.	• All central-level (tertiary care) hospitals (five in number). • In all regional and sub-regional hospitals (three in number). • In all teaching hospitals (medical college – 15 in number). • In 14 zonal hospitals.	• National Academy of Medical Sciences, Bir Hospital, Kathmandu. • BPK Institute of Health Science. • TU, Teaching Hospital, Kathmandu. • Maternity Hospital • Patan Academy for Health Sciences, Kathmandu • Kanti Children's Hospital, Kathmandu • Three Regional/ Sub-regional hospitals – Pokhara, Surkhet, Birgunj)	• USAID, WHO, UNICEF, WFP, FAO • World Bank, KOICA, DFID, AusAid, CIDA • MI, GIZ

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		• Iodine month (February) celebrated each year for raising awareness of importance of intake of iodized salt in daily diet. • NDHS 2011 showed 80% households consuming adequately iodized salt and target is more than 90% by 2015. • Second IDD action plan is under way.	Third phase • To review and revise Salt Act and include protocol for individual salt intake. • To develop, circulate and implement statutory warning on salt intake. • Review and revise national nutritional policy/strategies and include salt intake protocol. • Review and revise national legislation for food labels focused on limit of salt content as per protocol in food items. • National IEC/BCC campaigns. • Include individual salt intake protocols in school health and hygiene text books.			• 14 zonal hospitals	
7	SRL	• Subnational survey done in 2012. • Food -based Dietary Guidelines to reduce 5gm/day salt intake. • National NCD Policy for reduction of salt intake.	• Report submitted to Food Advisory Committee and national IDD control executive committee with request to carry out DIS survey. • Prepare proposal and budget estimate for DIS baseline survey (24 hr urine). • Strengthen the MRI laboratory to carry out sodium test (equipment, reagents and manpower) with help of GoSC and other partners. • Carry out DIS survey and establish baseline dataset.		Basic laboratory requirements and manpower	Establish programme for DIS estimation approval for using existing manpower for laboratory facilities and other remaining resources to carry out DIS survey.	• Financial assistance for equipment and logistics requirements for DIS survey. • Technical advice and training of survey team (capacity building).

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8	THA	• The Fifth National Health Examination Survey 2014. • Legislation of Food Labelling (simplified). • Food reformulation with low salt, low fat (collaboration between Thailand MoPH and US CDC). • Project of reducing salt, fat and sugar (campaign).	To continue to work in activities as mentioned in the earlier section.				
9	TLS	DIS not applicable	• Take DIS issue in nutrition working group. • Maintain and extend salt iodization at district levels. • Strengthen nutrition education. • Develop guidelines/strategies with technical assistance from development partners. • Advocacy	• Technical adviser/ technical assistance for DIS activities. • SOP for estimation of DIS in 24-hour urine. • Global reference of DIS, costing budget. • Laboratory facilities. • Baseline survey on DIS (cooking, processed food, salt added at the table).	Not applicable in our country (need assistance)	Capacity-building for programme officers • Ministry of Health (national laboratory) • Ministry of Commerce and Industry. • Ministry of Education. • Ministry of Justice. • Ministry of Agriculture and Fisheries.	• WHO • UNICEF • WFP

Increased blood pressure is the leading risk factor for death and the second leading risk for disability by causing heart disease, stroke and kidney failure, globally. The World Health Organization is promoting the reduction of salt intake to 5 g/day for adults as a cost-effective strategy to reduce hypertension and the overall burden of noncommunicable diseases, while at the same time promoting universal iodization of edible salt for the prevention and control of iodine deficiency disorders (IDD). Synergizing both programmes by promoting their commonalities and complementarities is an essential component of public health. The WHO Regional Office for South-East Asia organized a regional workshop on sodium intake and iodized salt for Member States in the South-East Asia Region. The general objective of the workshop was to strengthen an integrated approach for sodium reduction and salt iodization programmes in the Member States of the Region. The key recommendations of the workshop for countries of the Region included the establishment of baseline dietary salt intake data, public education and behaviour change communication to address the issue of high dietary salt intakes. Addressing the food industry to reduce salt in processed foods but, at the same time, to use iodized salt in their products, and the setting up of a joint national committee to harmonize dietary salt reduction and salt iodization were also recommended.

World Health Organization
Regional Office for South-East Asia
World Health House
Indraprastha Estate,
Mahatma Gandhi Marg,
New Delhi-110002, India
www.searo.who.int

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