Chapter 30
Experiences in Total Diet Studies in Indonesia

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Introduction

The National Agency for Drug and Food Control (NADFC), Republic of Indonesia, is responsible for the main food safety program associated with the Government Regulation on Food Safety, Quality, and Nutrition of Indonesia No. 28/2004. Several ministries, agencies and district governments share the authority for food safety control along the entire food chain from farm to table. The NADFC monitors and controls commercial foods on a regular basis as to whether or not they comply with limits set in the regulations and based on risk analysis principles in its food control program.

Risk assessment is essential in making effective scientific-based risk management decisions. However, exposure assessment of toxic chemicals in Indonesia has thus far not been part of the process in producing scientific data in chemical risk assessment. Therefore, the NADFC has been developing some pilot exposure assessment programs and related activities in preparation for a national total diet study (TDS) and to identify potential constraints which might exist in the implementation of a TDS, so that appropriate strategies and approaches to solving them could be determined.

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Challenges in the Indonesian Total Diet Study

The approach used by a country in undertaking a TDS should be in line with national concerns as well as those raised globally by the Codex Alimentarius Commission and GEMS/Food [1]. Dietary exposure assessment in Indonesia, as a developing country, is inadequate and challenged by a number of factors, such as a lack of databases required, infrastructure, resources, expertise, and experience. These challenges need to be addressed before implementing a national TDS in Indonesia [2].

Indonesia has more than 230 million people of diverse ethnic groupings living among thousands of islands, so the scope and coverage of food safety control in Indonesia is a very large challenge. Food consumption patterns are quite variable and may vary by age, sex, ethnic group, or availability and cost of the food. Besides food consumption habits, Indonesian society also has considerable variety in food recipes and preparation as well as cooking methods.

The accuracy of total diet studies relies on two fundamental data components: the quantity of each prepared food consumed by individuals, usually collected in national surveys, and the background concentrations of chemicals in the foods as ready for consumption. Estimates of the individual daily intake of food additives should only be undertaken when representative national dietary surveys are available [3]. Unfortunately, food consumption data based on individual dietary surveys are lacking in Indonesia. Therefore, Indonesia needs both individual food consumption data and chemical concentration data for the diets consumed by its population.

Foods usually consumed by Indonesians vary depending on ethnic groups and geographical distribution of the population and are characterized by different eating habits, recipes or food composition. The foods could be processed or prepared foods and distributed nationally and/or regionally. These factors make determination of a food list and shopping list for the Indonesia TDS more complicated and therefore a regional or cluster approach was developed [4].

Implementation of a national TDS should also be supported by facilities, such as a food preparation kitchen and laboratories for sample analysis. Indonesia is a large archipelago state with 34 provinces, so both its demography and geography present a challenge in implementing a national TDS. Kitchen and laboratory facilities will need to be well managed. For Indonesia, these facilities are available at the central as well as regional levels. Furthermore, implementation of a national TDS relies on competent staff with sufficient knowledge, and skills to conduct a TDS.

Development of Total Diet Studies in Indonesia

A step-by-step approach for the implementation of the national TDS in Indonesia has been carried out. This includes a number of pilot studies, such as development of exposure assessments of food additives based on maximum limits in 2002;

exposure assessment of primary school students in Malang to food additives with a TDS approach in 2002–2003; a pilot project for an integrated individual dietary intake survey for the purposes of exposure assessment and nutrition in 2003–2004; technical meetings, seminars, workshops on TDSs and implementation of a TDS in Indonesia, from 2004 through 2006; assessment of food consumption cluster diets in 2007; and exposure assessment of primary school students to cyclamate with a TDS in Surabaya during 2006–2007. Chemical risk assessment of heavy metals in fishery products consumed by vulnerable groups in Bandung, Semarang, and Mataram cities was undertaken in 2008–2009. Some of these experiences in conducting pilot exposure assessments are summarized below.

Exposure to Food Additives Based on Maximum Limits

A preliminary study of exposure assessment to food additives was conducted by the NADFC from October to December 2002 with the support of International Life Sciences Institute (ILSI) Southeast Asian Region. The objective of the study was to develop a self-assessment method using individual dietary records of food intake. There were 192 respondents from 15 provinces in Indonesia involved in the assessment. The food consumption survey was carried out using the 24-h food diary method while food additive concentrations were assumed based on maximum national limits. The result of this study showed the average intake of benzoate was 0.96 mg/kg body weight/day, which was 19 % Acceptable Daily Intake (ADI) established by the Joint FAO/WHO Expert Committee on Food Additives (JECFA). For the high (95th percentile) consumer, the exposure was 3.08 mg/kg body weight/day. It was also reported that the average intake of benzoate for the high consumers of young children (2–12 years) almost exceeded the ADI (5 mg/kg body weight/day) [5]. It was concluded that the self-assessment of food consumption could be applied in a broader survey.

Exposure Assessment of Cyclamate, Saccharin, and Benzoates Using a Total Diet Study Approach

The NADFC has regularly reported that foods sold in school areas by street food vendors across Indonesia contain artificial additives, such as sweeteners and preservative agents. However, it was not known whether or not these two classes of additives exceed their corresponding ADI levels. As young children are thought to be more susceptible to toxicological risk related to food additives, the NADFC extended its efforts to develop its exposure assessment of food additives by including cyclamate, saccharin, and benzoates in a total diet approach. It involved primary school students in Malang, East Java, Indonesia as respondents in a pilot project, which was conducted from December 2002 until December 2003 [6].

The objective of the study was to estimate the daily intake of various types of food products; to obtain basic data for the market-basket based study (total diet study); and to assess if the intake of cyclamate, saccharin, and benzoate by primary school children may be exceeding their respective ADIs. The outcome of this study was not only used as a model for the safety evaluation of food additives and toxic chemicals, but also as a model for the national TDS.

Seventy-two respondents who were 6–12-year-old male and female children were randomly selected from three primary schools representing low, middle, and high social-class schools in Malang, East Java, Indonesia. Each respondent was surveyed for his/her food intakes over six successive days. Food diary and dietary recall approaches were used to determine individual food consumption. The enumerator validated the respondent's record, which was combined with dietary recall by respondents during the interview. The interviews were conducted twice a day, before and after school, to obtain a 24-h individual intake record. The shopping list generated from the consumption data was utilized for a developing the market basket of food, which reflected the total diet of the consumers in the study.

For the analysis of samples, the food composite approach was used, in which individual food items were combined to represent groups of similar foods. One hundred and ninety seven food items were recorded in the consumption data and 81 food items were sampled and analyzed in the study. These accounted for 95 % of the total food intake by weight and consisted of 31 national food items, 6 local food items, 9 unregistered food items and 35 ready-to-eat food items. Ready-to-eat (RTE) foods were the highest contribution (70 %) of the total weight intake, and were dominated by the cereals food group, which accounted for 33 % of RTE foods consumed.

The average estimated intakes of cyclamate were about 240 % of the JECFA ADI, with main contributors being beverages and cereal-based snack foods. The daily intake of saccharin and benzoate was estimated to be about 12 % and 74 % of the JECFA ADIs, respectively [7–9]. It was suggested that an intervention for reducing cyclamate intakes among primary school children should be undertaken by the school community through school food safety programs and should involve the school commission, teachers, students, parents, food vendors, and the school canteen.

Exposure Assessment of Cyclamate Using a Total Diet Study

Given the previous findings among school children in Malang, cyclamate was considered as important additive to be assessed further. A similar study on exposure assessment of cyclamate was conducted in 2006–2007 and involved 716 respondents aged 6–12 years old in 30 primary schools but this time in Surabaya, East Java, Indonesia. Food consumption data was obtained by individual dietary intake survey using a food frequency questionnaire (FFQ). The food list in the FFQ was developed from a pre-survey using 24-h dietary recall data combined with data from food

diaries covering 3 consecutive days. The average estimated cyclamate exposure in this study was 260 % of the JECFA ADI. The important finding in the study was the excessive levels of cyclamate found in the foods consumed, which were well above the standards set for addition sweeteners to those foods. Using permitted maximum levels [10], the average estimated cyclamate exposure should have been only 27 % of JECFA ADI, and about 90 % of JECFA ADI for the highest consumer [11].

Lessons Learnt from the Experience

Indonesia has been learning some important technical and management lessons during the pilot projects undertaken as well as other preparation activities. Some important technical aspects needing attention are the validation of TDS procedures, method validation for food chemical analyses, pretesting of analytical systems, the sampling framework, food recipe and composition database, technical aspects in sample preparation, i.e. cooking, and especially laboratory proficiency testing.

Validation of procedures in TDS is important and includes testing the appropriateness of methods to be used, whether all preparation for TDS works well, and to identify potential problems that may need corrective action or improvement. As Indonesia's demography and food consumption patterns and habits are quite diverse, it may require a specific approach or adjustment in every region or cluster. However, the validation might best be conducted in only a selected site in each cluster or region to optimize project time and resources.

Selection of the location of survey and its supporting facilities as well as sampling points are an important step in establishing the sampling framework, as it will greatly influence sampling activity. Results of previous dietary intake surveys can be very useful to help shape a sampling plan. Food consumption cluster data is important to optimize the food purchasing and preparation of food samples. Cluster zoning is a possible approach to determine the best locations for sampling in a national TDS in Indonesia. It will also influence the selection and establishment of preparation and cooking facilities in each cluster because the sample would be prepared or cooked at the district level and composited at the central or national level.

Indonesia also should take into account the availability and variety of samples that must be collected in the market. Hence, it might need to include questions of where and how respondents obtain the food they usually consume. A database of food recipes or composition, especially for local or regional foods, should be available to develop a comprehensive food list and sampling protocol. For example, the food named "soto" (kind of clear soup) in Jakarta (*soto Betawi*) is very different in composition with "soto" in East Java (*soto Madura*). The local name of food should be defined along with its regional or national name so that food sampling in the market would be easier and accurate. For example, the food namely "utri" in Jakarta has same composition with "lemet" in West Java. Cooking methods are also

important information that should be gathered during consumption surveys. For example, rice cakes “lontong” and “arem-arem” have different cooking methods – “lontong” is made from uncooked rice (*beras*) without filling then steamed, while “arem-arem” is made from rice (*nasi*) with vegetable filling then steamed.

Food preparation facilities, including equipment and utensils, should be such that external contamination to the sample can be minimized. Laboratory proficiency testing is also important to check the competency of laboratories to measure chemicals at the low levels required by TDS criteria.

Future Preparation for the National Total Diet Study

The need for monitoring chemicals in the food supply is essential as consumers and regulators need to know what risks are posed by toxic chemicals and nutritional imbalances in foods consumed. Accurate information on people's actual total dietary exposure to chemicals is essential for risk assessment and can also be used in determining whether there may be a relationship between observed adverse effects in humans and exposure to a particular chemical. Indonesia therefore needs a TDS because it is an important basic activity that can reflect food safety status in a country, show trends and serve as basis for assessing the effectiveness of food safety control measures. Outputs from a TDS provide solid scientific data and information which can be used in developing national food safety programs, prevention and control, public health and nutrition programs, food safety regulations as well as standards, food safety intervention program priorities, targeted survey and monitoring programs, and as a contribution to international food safety programs, i.e. the Codex Alimentarius Commission and GEMS/Food.

A master plan for a national TDS should be developed and take into consideration Indonesia’s needs and specific characteristics. A logical and proper framework for the national TDS program should be established to focus on the overall goal, the objectives and targeted outputs of the food safety program. Hence, advocacy of key stakeholders and appropriate policy makers should be organized to raise their awareness to the importance of a TDS and their support in setting priorities in the TDS.

Achieving a national TDS in Indonesia will require resources, expertise, and capacities from all involved ministries and agencies in a spirit of partnership throughout the planning and implementation process. A strong commitment by each organization is an imperative to make an effective TDS a reality, as each has specific strengths and roles. This will also minimize overlap or avoid gaps in TDS implementation [12]. The proposed steering committee for the management of a national TDS in Indonesia would be led by the Ministry of Health with the technical team consisting of relevant authorities in nutrient and food safety programs in Indonesia as well as other experts. Table 30.1 describes the proposed partners and their roles in a national TDS in more detail.

Table 30.1 Proposed management of a national total diet study program in Indonesia

Institution	Role/tasks
Ministry of Health (MoH)	Coordinator of National TDS Program, coordinator of nutrients assessment, management and processing of food consumption data, analysis of nutrients in ready-to-serve and processed foods
National Agency of Drug and Food Control (NADFC)	Coordinator of exposure assessment, coordinator of food sampling, analysis of food additives and contaminants in processed foods
Ministry of Agriculture (MoA)	Analysis of contaminants in fresh foods and ready-to-eat foods rather than processed foods, except the fish and seafood groups
Ministry of Fisheries and Marine Affairs	Similar to MoA but limited to the category of fish and seafood
Local governments (provincial/district/city level)	Food sampling
BPS-Statistics Indonesia	Support food consumption and TDS data analysis
National Food Safety Network	Coordinator of peer reviewer group including experts and resource persons in related fields, i.e. universities, research institutes, and competent authorities in health and food safety. The team will also facilitate data analysis and TDS results interpretation as well as develop recommendations to be followed up by relevant institutions based on the risk analysis framework

References

1. GEMS/Food is the abbreviation for the World Health Organization's Global Environment Monitoring System/Food Contamination Monitoring and Assessment Programme
2. Sparringa RA (2004) Country progress report: pilot programs and the preparation for National Total Diet Study in Indonesia. Presented at the 3rd international workshop on total diet studies, Paris, 14–21 May 2004, WHO, Geneva
3. WHO (2001) Guidelines for the preparation of working papers on intake of food additives for the joint FAO/WHO expert committee on food additives, WHO, Geneva
4. NADFC (2007) Report of assessment of food consumption cluster in Indonesia. Directorate of food safety surveillance and extension (unpublished), National Agency for Drug and Food Control, Jakarta
5. Sparringa RA, Susalit SI, Fardiaz D (2002) Development of food diary method: self-assessment of exposure level to food additives. 2nd ASEAN food safety standards harmonization workshop, ILSI SEA, Kuala Lumpur
6. Sparringa RA, Slamet R, Rahayu WP, Fardiaz D (2004) Exposure assessment of elementary school students to food additives: a total diet study. In: Proceedings of 4th Asian conference on food and nutrition safety, ILSI-SEA, Denpasar, 2–5 Mar 2004
7. Sparringa RA, Rahayu WP (2005) Exposure assessment of elementary school children to cyclamate and saccharin: a total diet study. In: Proceedings of the Asia food conference, LIPI, Jakarta 9–12 Aug 2005
8. Rahayu WP, Sparringa RA (2006) Exposure assessment of elementary school children to benzoate with total diet study approach. In: Proceedings of the 13th world congress of food science and technology, International Union of Food Science and Technology, Nantes, 17–21 Sept 2006

9. Sparringa RA, Rahayu WP (2006) Food contamination monitoring programme and preparation of the total diet study in Indonesia. In: Proceedings of 4th international workshop on total diet studies, Beijing, 22–27 Oct 2006, WHO, Geneva
10. NADFC (2004) Head of NADFC decree No HK.00.05.5.1.4547 on technical regulation of artificial sweeteners in food products. National Agency for Drug and Food Control, Jakarta
11. Sparringa RA (2008) Studi Diet Total dan Kajian Paparan Bahan Kimia dalam Pangan [Total diet study and chemical risk assessment in foods]. Pra 2 Widya Karya Nasional Pangan dan Gizi, National Agency for Drug and Food Control, Jakarta, 9 Juni 2008
12. Rahayu WP, Sparringa RA, Prabowo AN, Puspitasari R (2007) Experiences in conducting pilot TDS in Indonesia. Regional workshop on total diet studies. Jakarta, 5–7 Dec 2007, WHO SEARO, New Delhi