
On May 30, 2013, ILSI Southeast Asia Region, together with the ILSI Indonesia Country Committee and Southeast Asian Food and Agricultural Science and Technology (SEAFAST) Center, organized the half-day Seminar on ‘Uses and Safety of Sweeteners’ at the Hotel Borobudur in Jakarta, Indonesia. The meeting was attended by more than 130 local and international participants from both the public and private sectors.

Ms. Pauline Chan, Director of Scientific Programs at ILSI Southeast Asia Region provided the introduction to the seminar. This was followed by welcome remarks from Dra. Engko Sosialine, Director of Production and Distribution of Pharmaceutical Services, who welcomed the participants on behalf of Dra. Maura Linda Sitanggang, Director-General of the Department of Pharmaceutical Services and Medical Devices, Ministry of Health, who was unable to attend. Finally, Dr. Roy Sparringa, Deputy III at the National Agency for Drug and Food Control provided the final welcome address and declared the meeting open.

Session 1: Introduction to Sweeteners and Uses

In his presentation on “Use of Sweeteners in Food and Beverages”, Prof. Dedi Fardiaz from Bogor Agricultural University provided an overview on the science of sweet taste and considerations relating to the use of sweeteners in food and beverage products. Prof. Fardiaz explained that the ability to perceive sweet taste involves the binding of specific “sweet” molecules containing hydrogen bond-forming groups (such as hydroxyls and amines) that are configured as geometrical “saporous” units, to sweet receptors of the tongue. Non-sugar sweeteners also contain these “saporous” units. However, any changes to the geometrical configuration of these compounds may result in the loss of its sweetness, such as in the case of chiral isomers of aspartame. Sweetness of non-sugar sweeteners are generally measured by comparing them to sugar (sucrose), using a standard of a sugar solution of 36 mg/ml. There are many different ways of classifying sweeteners, depending on its source (‘natural’ or ‘artificial’), properties (‘intensive’ or ‘extensive’) or nutritional value (‘nutritive’ or ‘non-nutritive’; ‘non-calorie’, ‘low-calorie’ or ‘reduced-calorie’). When using sweeteners to replace sugar in food and beverages, sweetness alone is not the only
consideration, as other factors including body, astringency, bitterness and aftertaste are also important to the overall flavor profile. To achieve a desirable flavor profile, manufacturers often use compound sweeteners (sweetener blends that consist of more than one type of sweetener) in food or beverage products.

Following this introduction to sweeteners, Dr. Fiaistuti Witjaksono from the University of Indonesia then presented on the “Relevance of Sweeteners to Health and Diet”. Dr. Witjaksono shared that existing dietary guidelines, both at the international and national levels, usually recommend consumers to moderate their consumption of sugar to prevent excessive caloric intake. For example, the Indonesian General Guides for Balanced Nutrition recommends that not more than 5% of total energy should be derived from sugar. These recommendations are intended to lower the population risk for developing conditions and ailments caused by excessive caloric intake, such as obesity, hypertension and diabetes. In relation to this, non-nutritive sweeteners have the potential to play a supporting role in achieving these desired public health objectives, as they contribute little to no caloric value when used in foods and beverages and may therefore be used to help with managing total calorie intake. In the case of diabetics, substitution of sugar in food and beverage products with non-nutritive sweeteners can also provide such consumers with a wider range of food choices. Compared with sugar, use of sweeteners also does not promote tooth decay.

Session 2: Safety and Exposure Assessment of Sweeteners

While there are many potential applications and benefits for the use of sweeteners in foods and beverages, it is nonetheless important to ensure that all sweeteners sold on the market are safe for human consumption. Dr. Berna Magnuson from the University of Toronto, Canada, thus shared how the safety of sweeteners are established in her presentation on “International Safety Assessment of Sweeteners”. She explained that non-nutritive sweeteners are generally classified as food additives rather than food ingredients. At the international level, the safety of food additives is assessed by the Joint FAO/WHO Expert Committee on Food Additives (JECFA) and establishes the Acceptable Daily Intake (ADI) for these compounds in food. JECFA applies the scientific principles of risk assessment in evaluating the safety of food additives, which consist of four steps - hazard identification, hazard characterization, exposure assessment and risk characterization. These principles have been thoroughly described in the WHO Monograph, “Environmental Health Criteria 240: Principles and
Methods for the Risk Assessment of Chemicals in Food”. In the case of sweeteners, comprehensive series of toxicological studies are normally conducted to support the evaluation of its safety, including studies on the mutagenicity of the compound, its pharmacokinetics (fate in the body), its potential to cause adverse effects including cancer, as well as its ability to affect reproductive functions and development. In addition, in the event that susceptible populations of consumers are identified, additional testing would be required to address concerns that may potentially affect these populations. Toxicological studies that are used in the safety evaluation of sweeteners generally need to be conducted using standardized toxicology protocols, so as to ensure that the data are of high quality and the results are clearly interpretable. After reviewing such toxicology studies, risk assessors can then determine the ADI based on the No Observed Adverse Effect Level (NOAEL) for the most sensitive critical health outcome in the most sensitive species of animals used for the experiments, after applying a combined safety factor of 100 to account for the inter-species extrapolation of the results from animals to humans, as well as for intra-species variation between individuals of a population. The ADI for a sweetener is the amount of it “that can be ingested daily over a lifetime without appreciable health risk”. It is generally applicable for the entire population including sensitive subpopulations (such as pregnant women and children), but not for infants less than 12 weeks old.

After an ADI has been established, the next step in the risk assessment process involves the estimation of exposure of a population to the sweetener. The process, methods and considerations for conducting dietary exposure assessments for sweeteners were elaborated in the presentation on “Estimating Exposure to Sweeteners in the Diet” by Mr. John Howlett, an independent food scientific and regulatory affairs consultant from the United Kingdom. Mr. Howlett noted that exposure assessment should be conducted within the context of the risk analysis framework, which is described in the Codex Alimentarius document on “Working Principles for Risk Analysis for Food Safety for Application by Governments (CAC/GL 62-2007)”. Estimation of exposure to food additives in the diet, including sweeteners, combines information about the levels and patterns of use of the additives in foods and beverages (occurrence data), with information about the quantities of those foods and beverages containing the food additives that are consumed by a general or specific population (food consumption data). Sources of occurrence data for conducting dietary exposure assessments for food additives may include disappearance data (e.g. total production figures of the food additive); maximum permitted use levels in food standards and regulations; reported use levels by the food
industry; as well as laboratory analysis data of the food and beverage products. In the case of sweeteners, data from analytical surveys have often found that the actual use levels of sweeteners in food and beverage products are well below the maximum permitted use levels set by government regulations. Sources on food consumption data on the other hand, may include food disappearance data (e.g. amount of food entering the national food chain), as well as data from food consumption surveys conducted either at household or individual levels. A stepwise approach is generally recommended when undertaking exposure assessment, starting with less refined estimates that apply more conservative assumptions (e.g. screening methods and “budget” method) and progressing towards more refined estimates, which give a more realistic picture of the actual exposures (e.g. deterministic modeling, simple and refined probabilistic modeling). As the methods applied to calculate exposure become more refined, the data and resource requirements will also correspondingly be greater. However, regardless of the method chosen to conduct the exposure assessment, issues relating to the limitations of the assessment, assumptions applied, as well as sources of uncertainty that may impact the accuracy of the exposure estimate, need to be carefully reviewed and clearly documented in a transparent manner.

After the comprehensive review of the risk assessment procedures for sweeteners, Ir. Gasilan from the National Agency for Drug and Food Control (NADFC), Indonesia, shared the Indonesian experience on risk assessment and regulation of sweeteners in his presentation on “Safety Risk Assessment of Food Additives”. The relevant Indonesian laws and regulations that regulate different aspects of food additives include Law No. 18, 2012 on Food; Government Regulation No. 69, 1999 on Food Labeling and Advertisement; Government Regulation No. 28, 2004 on Food Safety, Quality and Nutrition; Government Regulation No. 21, 2005 on Biosafety of Genetically Modified Products; and Health Minister Regulation No. 033, 2012, on Food Additives. Additionally, the National Agency for Drug and Food Control has also issued regulations specifying the maximum limits for the use of all functional classes of food additives except for sweeteners, which is still being finalized. In relation to the approval for use and setting of maximum limits for food additives, authorities in Indonesia take into consideration international risk assessment opinions by JECFA; scientific opinions from other scientific institutions including universities; Codex Alimentarius standards; as well as food additive regulations of other countries. In addition, exposure assessment is also conducted during the pre-market approval process for food additives, with the maximum levels set so that exposure to a particular additive in food and beverage products
will not exceed 50% of its ADI. Additional data for exposure assessments are also obtained from existing monitoring and surveillance data collected by the NADFC. The differences in the maximum permitted use levels for food additives in Indonesia, as compared with Codex Alimentarius General Standard for Food Additives and other countries, are mainly due to the differences in exposure estimates resulting from different food consumption patterns. With regards to the standards of use for sweeteners in foods and beverages, the Ministry of Health Regulation No. 033, 2012, on Food Additives currently allows for the use of 8 natural sweeteners and 6 artificial sweeteners. However, Alimate, which was previously permitted in earlier regulations, has now been delisted as there has not been any record of its use by the industry in Indonesia since its initial approval. As NADFC is currently still finalizing the maximum permitted levels for sweeteners, the permitted levels contained in previous regulations issued by the Ministry of Health (Regulation No. 722/Menkes/Per/IX/88) and NADFC (Decision No. 00.05.5.1.4547 of Year 2004) are still in force.

The final presentation of the seminar was provided again by Dr. Berna Manguson, who spoke on the topic of “Approaches to Evaluating Safety of ‘Natural’ versus ‘Artificial’ Sweeteners - Is There A Difference?” Dr. Magnuson explained that there are in principle no differences in the evaluation process for ‘artificial’ versus ‘natural’ sweeteners, as food safety authorities generally require food additives to meet the same standards of safety regardless of their source or origin. This is because both natural and artificial compounds have the same potential for toxicity, with many compounds found in nature actually known to be toxic as well. However, specific considerations relating to each category are sometimes taken into account during the safety evaluation process. For natural compounds, this includes information on its history of use, which must be well documented for the general population. In addition, natural compounds intended to be used as food additives also need to be adequately characterized to ensure consistency of its composition and purity, as variations in the growing conditions, harvesting, and processing methods of the plant source may lead to compositional difference or the introduction of contaminants such as pesticide residues. Such considerations were illustrated through a case example on JECFA’s risk assessment process for steviol glycosides, which require a longer time due to the need to take into account these additional factors to establish its safety. Therefore, the source of a compound regardless of whether it is ‘natural’ or ‘artificial’, is less of a critical factor in establishing its safety than the amount consumed, since ultimately it is “the dose that makes the poison”.