Need for food reference materials in Asia

R. F. Florentino, A. V. Lontoc, T. R. Portugal, and A. R. Aguinaldo
Food and Nutrition Research Institute, Manila, Philippines

Summary. A survey was conducted to determine perception, knowledge, use or application of Food Reference Materials (Food RM) in Asia and to assess individual country needs for these materials. Respondents of the questionnaire came from government institutions, private laboratories, food industries and state universities in 12 countries in Asia involved in food composition data generation. Results showed that only a third of the respondents had been using Food RM in their studies while the remainder were either unaware or not using these materials for logistical reasons or unavailability. The survey revealed emerging interest on the need to establish a Food RM Program in Asia. A common implementation strategy expressed by respondents is the creation of a center, where Food RM can be developed. This center will also be entrusted with the distribution of Food RM and collection, monitoring and evaluation of analytical data. The survey results will help ASIAFOODS in formulating guidelines or planning action regarding the use of Food RM to ensure accurate and dependable food composition data in the Asian region.

Introduction

The increasing concern both among technical people and consumers about the effect of nutrients and other substances found in food on the health and quality of life of individuals calls for reliable food composition data. The variety of activities in this field ranges from studies on the geographical patterns of diseases and the assessment of nutritional status of populations, to the design and implementation of local, national and international food production and feeding programs, and to institutional meal management and dietary counselling.

In general, information on food composition is used in two ways: first, for the conversion of foods into nutrients, and second, for the conversion of nutrients into foods. In the first instance, food composition data provide information on the amounts of nutrients in the food supply or in diets as gathered. In the second, food composition data provide information on the most advantageous food or food combinations. From these general uses, food composition data have been applied in a variety of ways, namely: nutrition and public health surveys, nutrition education, planning food assistance programs, dietetics and clinical practice, nutritional epidemiology, agriculture research, food industry, food regulation and consumers' demand.

Offprint requests to: R. F. Florentino

Quality considerations of food composition data

The present food composition data are limited with regard to representativeness and adequateness of description of the sample and appropriateness of the analytical methods used. The chemical, biochemical or biological methods used may to a lesser or greater extent lack in specificity, sensitivity and precision for the compound analyzed [2]. A method optimized for one particular sample may not provide the same accuracy for a different sample type. Although ideally, one method should be used, this is not commonly realized because of the variability in composition of the different types of foods [6].

Greenfield and Southgate [3] emphasized that the values entered into a food composition data system should be of high quality. They should be accurate and derived from original analytical data from rigorously scrutinized published (preferably) or unpublished sources. They should be produced by analytical methods that are carefully chosen and validated by laboratory quality control procedures. The selection of appropriate methods of analysis should consider analysis time, applicability to the broadest range of sample types, reasonable accuracy that can be appraised with the use of Food Reference Materials (Food RM), good reproducibility, cost and hazards involved [6]. On the other hand, validation should test all phases of the analytical procedure namely: homogenization, subsampling, separation, detection and identification, calculation of the results and preparation of the report. Validation of methods may be done by use of standard reference materials, adopting in-house standards, conducting check sample surveys and blind analyses [3]. Quality control measures include proper use of controls and reference standards, replicate analysis, recovery studies, control of reagents, control of instrument and equipment performance, among others.

Control of quality of the operation through time with the use of quality control charts will show whether an analytical procedure is "in-line" or "out-of-line" [5]. This will also determine the reliability of the data from the use of control samples, e.g. Food RM. On the other hand, a systematic and accessible record will ensure easy search back and audit trail [3].

Wolf [8] likewise stressed that validation of analytical methods require the analysis of known, certified primary standards of similar matrices as proof of accuracy. The

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primary food standard has the constituent held in similar physico-chemical form as the food to be analyzed and thus can test all phases of the analytical procedure.

Food composition data in Asia

Currently available food composition tables in Asia show large gaps both in food items and food constituents reported. Some data are out-of-date or of uncertain quality. These problems are complicated by the increasing development and marketing of new foods, the increasing mobility of people and foods, the changing eating patterns, the changing concepts in nutrition, the increasing level of accuracy of developed analytical methodologies, and the ever-increasing emphasis on quality of data in the face of information explosion. Thus, each food composition table finds it difficult to keep pace with all of these changes [7].

ASIAFOODS activities and plans

The first ASIAFOOD meeting in Bangkok, Thailand, from 17–21 September, 1984, with representatives from 12 Asian countries was convened to: (a) consider the organization of ASIAFOODS (as component of INFOODS) and (b) discuss needs relating to food composition data generation, compilation and use within the region. The goal of ASIAFOODS, as agreed upon in the meeting, is to have in each country national food composition tables that are complete, accurate, up-to-date and in accessible form. To attain this goal, national and regional activities were recommended. A national working group on food composition would be organized in each country to identify needs, and plan and coordinate food composition work within the country. Cooperative efforts among countries in the region would ensure the development of a comprehensive and detailed regional plan of action for improving the generation, collection and utilization of food composition data throughout the region.

The first ASIAFOODS Executive Committee met in Manila, Philippines, on 18–19 February, 1985 to: (a) discuss the progress of the activities recommended by the ASIAFOODS meeting in Bangkok; (b) compile a country survey of needs relating to food composition data; (c) develop a mechanism for regional collaboration and ASIAFOODS statutes; and (d) develop a regional project to reach the ASIAFOODS goals.

A proposal to have an ASEAN Food Data Network complement the ASEAN Food Habits Project and also to become an important input towards the development of ASIAFOODS network was also prepared and submitted to ASEAN SubCommittee on Protein for funding. Among the planned activities of the Network are the following:

(a) to develop guidelines for food composition data generation, compilation, distribution and use;

(b) to develop and strengthen mechanisms for information exchange;

(c) to strengthen regional centers for training, reference laboratories and data bases; and

(d) to support practical and advance training for scientists and technologists.

The proposed project will be for an initial period of 2 years where the main activities will be concentrated on the development of expertise within ASEAN countries. The subsequent period of the project will emphasize the generation and compilation of food composition data and promote the wide utilization of such data among potential users.

Survey on food reference materials in Asia

In response to the growing concern and need for the production of good quality food composition data as initiated by INFOODS and ASIAFOODS, the Food and Nutrition Research Institute conducted a survey among Asian countries which aimed at:

1. determining the perception, knowledge, use or application of Food RM in Asia; and
2. assessing individual country needs for Food RM.

It was hoped that the results of this survey will help formulate a plan of action regarding Food RM leading to the improvement of food composition data generation in the Asian region.

In this study Food RM was defined as any biological material which may or may not be a Standard Reference Material (SRM) certified by the National Bureau of Standards (NBS) or by any other certifying body. Uncertified Food RM may be any of the following: (a) house standards or laboratory's "standard reference materials" consisting of large amounts of a food material which are thoroughly homogenized and stored for periodic analysis with results monitored by a control chart, (b) analytical check sample series which are provided by certain organizations on a regular basis to participating laboratories in order to check the reliability of their method performance, and (c) authentic samples whose composition has been extensively studied and described in literature [1, 3, 4].

Method and population covered

A questionnaire was developed, pretested and distributed to food composition (nutrient, anti-nutrient and toxicant) data generators in the Philippines and other countries in the Asian region. Within the Philippines, the questionnaire was sent to data generators of research institutions both government and private, state universities and food industries. Outside the country, prospective respondents (also from research institutions) were contacted through officials of ASIAFOODS, ASEAN and embassies/consulates. Transmittal of the same questionnaire to other generators in their respective countries was requested from some respondents.

The choice of respondents and size of sample in this survey was limited by the authors' previous knowledge of actual data generators and established personal contacts within ASIAFOODS and ASEAN organizations. The main consideration in the evaluation was the respondents' perception, knowledge, use and application and need for Food RM in order to develop a strategy for Food RM in Asia.

Results

Of the 86 questionnaires distributed, 51 were returned completed by respondents representing 25 government institutions, 5 private laboratories and food industries, and 8 state universities in 12 countries, namely: Japan, India, Indonesia, Malaysia, Philippines, Nepal, Papua New Guinea, People's Republic of China, Taiwan, Singapore, Sri Lanka and Thailand. No response was received from

Table 1. Distribution of respondents

Country/institution	Nature of institution[a]					Field of study
	G	P	R	A	I	
Japan						
1. Japan Food Res. Lab.		×	×			Nutrient and anti-nutrient analysis
2. Kyoto University	×		×	×		Nutrient content and bioavailability studies
3. Ministry of Agric., Forestry and Fisheries	×		×			Nutrient, anti-nutrient and toxicant analysis
4. National Insitute of Nutrition	×		×			Nutrient content and bioavailability studies
India						
1. Central Food Technological Research Institute	×		×			Nutrient content, bioavailability and toxicant analysis
Indonesia						
1. Nutrition Research and Development Centre	×		×			Nutrient, anti-nutrient and toxicant analysis
2. Indonesian Insitute of Sciences	×		×			Nutrient analysis
Malaysia						
1. Institute of Medical Research	×		×			Nutrient and toxicant analysis
Philippines						
1. International Rice Research Insitute		×	×			Nutrient content and bioavailability studies
2. Ministry of Agriculture and Food	×		×			Nutrient content and bioavailability studies
3. National Food Authority	×		×			Nutrient and toxicant analysis
4. National Science and Technology Authority	×		×			Nutrient content, bioavailability and toxicant analysis
5. Philippine Coconut Authority	×		×			Toxicant analysis
6. Philippine Refining Company		×			×	Nutrient and toxicant analysis
7. San Miguel Corporation		×	×		×	Nutrient and anti-nutrient analysis
8. University of the Philippines	×		×	×		Nutrient content, bioavailability, anti-nutrient and toxicant analysis
Nepal						
1. Central Food Research Laboratory	×		×			Nutrient analysis
Papua New Guinea						
1. University of Technology	×		×	×		Nutrient analysis
Peoples Republic of China						
1. Institute of Health	×		×			Nutrient and toxicant analysis
2. Shanghai Railway Medical College	×		×	×		Nutrient and toxicant analysis
Taiwan						
1. Asian Vegetable Research and Development Center	×		×			Nutrient and anti-nutrient analysis
2. Fujen University	×		×	×		Toxicant content and biotoxicity analysis
Singapore						
1. National University of Singapore	×		×	×		Nutrient and toxicant analysis
2. Alfa Laval SEA PTY LTD.		×	×			Nutrient analysis
Thailand						
1. Thailand Institute of Scientific and Technological Research, MOST & E	×		×			Nutrient and toxicant analysis
2. Institute of Nutr. Mahidol University	×		×	×		Nutrient, anti-nutrient and toxicant content and biotoxicity analysis
3. Division of Nutr. Department of Health, MOPH	×		×			Nutrient analysis
4. Division of Food Analysis, Dept. of Medical Science, MOPH	×		×			Nutrient analysis
5. Division of Biological Science, Dept. of Science Service, MOST & E	×		×			Nutrient and toxicant analysis
Sri Lanka						
1. University of Sri Agewardenepura	×		×	×		Nutrient anti-nutrient and toxicant analysis

[a] *G* Government; *P* Private; *R* Research; *A* Academy; *I* Industry

Table 2. Food analysis using food RM, by country

Country/institution	Food component	Food RM	Source
1. Japan			
National Food Research Institute	Total N, metals	Wheat flour Rice flour	Nat. Bur. Standards, USA
Ministry of Agriculture, Forestry and Fisheries	Metals	Bovine liver Orchard leaves	Nat. Bur. Standards, USA
2. India			
Central Food Technological Research Institute (CFTRI)	Sodium	Bovine liver	Nat. Bur. Standards USA
3. Peoples Republic of China			
a) Institute of Health, China National Center for Preventive Medicine	Aflatoxins	Yellow corn meal Peanut meal Lyophilized milk	International Agency for Research on Cancer (IARC), France
b) Shanghai Railway Medical College	Selenium	Bovine liver	Nat. Bur. Standards, U.S.A.
4. Taiwan			
a) Asian Vegetable Research and Development Center	Carotenoids	Vegetables and fruits	prepared in AVRDC lab.
5. Philippines			
a) Bureau of Plant Industry	Aflatoxins Amylose	Peanut Rice flour	local local
b) International Rice Research Institute	Amylose Minerals	Potato flour Brown rice	Netherlands prepared in IRRI's Anal. Lab.
c) University of the Philippines, Los Baños			
	Protein	Skim milk	NBCo, USA
d) Food and Nutrition Research Institute	Aflatoxins B_1, B_2, G_1 and G_2	Yellow corn meal Peanut meal and Peanut butter	International Agency for Research in Cancer (IARC), France
	Aflatoxin M,	Lyophilized milk	International Agency of Research in Cancer (IARC), France
e) Philippine Atomic Energy Commission	Trace elements	Bovine liver	Nat. Bur. Standards, U.S.A.
		Kale	University of Reading, U.K.
7. Thailand			
Mahidol University	Proximate composition	Soybean flour	Prepared in own laboratory
MOST & E/MOPH	Minerals Vitamins Amino acids Fatty acids	Full cream milk powder	Prepared in own laboratory
	Heavy metals and Trace elements	Rye flour Animal muscle Milk powder Mussel tissue	IAEA

Bangladesh, Brunei, Burma and Vietnam. Table 1 shows the distribution of respondents by country, institutional affiliation and field of study. Most of the laboratories are concerned with nutrient, anti-nutrient or toxicant analysis, and a few are involved in bioavailability studies.

Perception of food RM

Food reference materials were generally defined by the majority of respondents as any food material with similar matrix as the food sample which is well characterized, produced in quantity, certified for chemical composition or physical properties and stored for periodic analysis with the results being monitored by a control chart. Although recognized as a reliable tool in evaluating laboratory performance, 31% of the respondents had not used them in their studies primarily due to problems on logistics, unavailability of Food RM appropriate in their work and anticipated deterioration of the material during shipment and storage. Most of them had relied on primary standards, house standards, recovery tests and other quality control measures for definitive precision and accuracy of data. Nevertheless, future plans for use of Food RM had been initiated in the laboratories of 75% of non-users through linkage with other users (scientists/laboratories) and manufacturers and access to literature on the application of these materials. Thus, with proper technical orientation and given adequate resources, these laboratories could use Food RM without major difficulty.

Use and application of food RM

While 33% of the respondents appeared to be unaware of the existence of Food RM, 16 data generators (31%) were using these materials in the analysis of proximate composition, amino acids, fatty acids, essential elements, vitamins, amylose, trypsin inhibitors, aflatoxin and heavy metals (Table 2). The reference materials had either been donated or purchased abroad from France, Netherlands, United Kingdom, or United States of America, while a few [as in the International Rice Research Institute (IRRI), Philippines; Asian Vegetable Research and Development Center (AVRDC), Taiwan; Mahidol University, MOST and E/MOPH, Thailand] prepared their Food RM in their own laboratories. Periodic test of analytical activity including the performance of reference materials assumed a major aspect of their quality control activities. The respondents stressed specifically the significance of Food RM in various aspects of the analysis, namely: quality control of methods, testing of technician and instrument proficiency, quality comparison of methods and products, and close check of methods with those of other laboratories. Unfortunately, two of these respondents have to stop using Food RM for similar reasons cited by non-users.

Recommendations

The survey revealed emerging interest in the need to have a Food RM program in the Asian region. The program would have to address problems on development of Food RM specifically for foods consumed in Asia. Furthermore, for a more reliable country or regional Food Composition Table to be realized, the role of Food RM as a reference sample in national, regional or international quality control program would have to be recognized more extensively in the region. The designation of a center in Asia where Food RM can be developed is a common implementation strategy expressed by majority of the respondents. Unfortunately, the questionnaire did not reflect the specific mechanics by which the strategy could be implemented. It was opined, however, that a laboratoy in the region has to study extensively the analytical application and validation of methods and the coordination of interlaboratory analysis of reference materials. Apparently, the laboratory has to be the most capable in the region, i. e. with sufficient expertise and financial and manpower resources. This center would be entrusted with the development and distribution of Food RM to Asian laboratories and collection, monitoring and evaluation of analytical data of these laboratories. Moreover, some respondents consider that a Food RM program can be better established through close linkages with laboratories using Food RM, e. g. AACC, AAFCO, AOAC, consultations, training conferences and workshops at regional and international levels and participation in collaborative laboratory analyses.

On the other hand, the assistance of INFOODS in the distribution of Food RM and data monitoring in Asian laboratories was seen by some respondents as a means towards effective implementation of the Food RM program.

Definitely, implementation of any of these strategies will necessitate logistical and technical support from international or bilateral agencies and demand collaborative efforts and more serious involvement among sectors generating food composition data in the Asian region. In order to ensure accurate and reliable food composition data in the region, ASIAFOODS would have to work actively in developing and formulating guidelines or planning action regarding the use and application of Food RM in the validation of analytical methods. Likewise, the role of INFOODS for a successful implementation of the Food RM program in Asia would be of great importance.

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