Issues and Problems in Using Food Composition Data in Asia

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INTRODUCTION

Food is a major component of man's environment. Data on actual nutrient composition of foods are critical for the important activities of a great variety of individuals and groups including those involved with epidemiological research into disease patterns, formulation of dietary recommendations, health assessment of individuals and populations, and national and international trade in foods. Owing to the fact that food types and their preparation vary tremendously from country to country and region to region, efforts have been made by each country in the generation and compilation of food composition data specific for their own use. These data, moreover, can be beneficial nationally and internationally when required.

However, preparation of good quality data with complete information which are accessible and meet users' needs requires many resources including time, planning, management skill, manpower and finances. Limitations and constraints in this process introduce a number of difficulties for users which must be overcome before any true thought can be given to data and information transfer. It is hope that continuous sharing of problems and experiences among generators, compilers and users as being done in this conference can lead to solutions to some of the most perplexing problems and provide a working concept rather than an abstract principle.

This presentation highlights a small sample of persisting problems and as reported by ASIAFOODS members which continue to influence the quality of data. All of these areas determine our ability to realistically exchange and use food composition data cross-nationally through common system.

NATURE AND PROBLEMS OF ASIAN FOOD COMPOSITION TABLES

For the Asian region, existing FCTs can be divided into roughly two types (**Table 1**). The first type includes those in which all data are generated from local resource materials, while the second includes local data as well as those from neighboring countries, other regions or even international data when available. According to relatively recent directories and country reports (1-3), most countries in the Asian region have their own national FCTs, though a regional FCT has not as yet been formulated although a definite desire exists among ASIAFOODS members.

TABLE 1: CHARACTERISTICS OF AVAILABLE FCTs IN ASIA

Country	Type of FCTs		Language used	
	A	B	Native	English
Brunei	------No national FCT available------			
China	o		o	(1)
Indonesia	o	?	o	
Japan	o		o	(2)
Korea		o	o	
Malaysia	o			o
Myanmar		o	?	?
Philippines	o			o
Sri Lanka		o		o
Taiwan		o	o	
Thailand	o	o	o	o

(A) : Generated by their own resources.
(B) : Generated by their own resource and compiled from other FCTs
? : No information is available

(1) : FCT is being translated.
(2) : English data is partially provided.

Unfortunately however, these FCTs are not without their problems, and these are thought to be mainly due to the generated FCTs themselves. Overall, the most common obstacles are the timeliness of data (are they up-to-date?), completeness (what information and/or data are missing or inadequate?), users' intentions, and the extent to which foreign data is included in local/national FCTs without regard to varying cross-national considerations. In particular, food composition data are vital to the work of a wide variety of users. This diversity, in itself, breeds problems, because data users have different expectations and requirements, many of which are beyond the capabilities of the generators. In addition, generators oftentimes possess very limited resources. Mechanisms to solve this problem are desperately needed, and which will most likely entail bringing users, generators and compilers into closer contact, so they can work together in a more coordinated fashion. Other specific problems are as follows.

1. Completeness of Available Food Composition Data in Asia: Specific Cases

1.1 Nutrient Components

The completeness of the data in Asian FCTs varies from country to country. As shown in **Table 2**, most include at least fifteen basic nutrients and some cover many more. The general information available are: 1) main nutrients (proximate composition) in which dietary fiber was presented as crude fiber; and 2) certain minerals and vitamins, i.e., Ca, P, Fe, vitamin A, carotene, vitamin B1, B2, niacin and vitamin C. Some particular nutrients can be obtained from certain FCTs or research papers which were published in local or international journals (i.e., macro-minerals - Na, K, Mg; trace elements - Zn, Cu, Mn, Se, I; and some vitamins - B6, folic acid, B12; as well as fatty acids and amino acids).

At present dietary fibre data, which is becoming more and more essential for clinical and epidemiological studies, are missing in all FCTs in Asia. However, limited data on dietary fibre content in foods -- as reported by Japan, Singapore and Thailand -- can be obtained from published journals or scientific papers (3-6). Developing dietary fibre data (total and its fractions, to be included into the national FCTs) is in the future plan of many countries, i.e., Japan, Malaysia, the Philippines and Thailand. An INFOODS recommended method for determination of dietary fiber and its fractions is requested.

For fat soluble vitamins, more accurate estimation of vitamin A value in a number of local fruits and vegetables, as well as foods of animal origin, are being carried out in Malaysia and Thailand using high pressure liquid chromatography. Hopefully, updated data on this nutrient will soon be available for inclusion in FCTs. Apart from vitamin A and carotene, only Japanese FCTs contain data on vitamin D and vitamin E. No data on vitamin K is available in all FCTs.

The Philippines FCT not only contains additional data on Mg, Cu, Zn, I, Mn vitamin B6, B12 and folate, but they also provide some data on anti-nutritional factors, e.g., phytin and oxalic acid as related to the bioavailability of nutrients.

1.2 Food Items

Data on nutrient composition of many food items are missing in each national FCT, especially foods infrequently consumed, specific local foods such as unconventional (but seasonally common) protein sources of people in rural areas, wild foods, and newly manufactured and/or distributed foods, either raw or processed. A crucial consideration which must be made in data exchange is to what extent are certain types of data wanted on an international scale. For example, the Institute of Nutrition has nutritional data on edible insects used as foods in rural Thailand. But whether or not this data is desired by INFOODS or other network members, and how it is to be compiled for dissemination, is unknown.

Many FCTs present data of raw foods even for foods usually consumed after being processed. Different processes of food preparation prior to consumption (such as boiling, steaming, frying, roasting) affect various nutrients at different degrees. This effectively limits the use of cross-national data which does not indicate exact preparation methods. Due to differences in culture and food availability, the process of cooking foods and ingredients used vary from country to country or even at different regions in the same country, which in turn greatly affects the composition of the processed foods. Many data on nutrient composition of processed and traditionally cooked foods can be obtained from FCTs; cases in point are the FCTs of Malaysia and the Philippines which also notes with serving size, and that of Malaysia also includes ingredients and methods of preparation/cooking. However, use of data on cooked foods can mostly be used within respective countries due to specificity of recipes and cooking methods.

2. Data Presentation

2.1 Presentation of Analytical Data

How data are presented will determine utility

amongst local and international users as well as amenability for computerization. To be of maximum convenience, worldwide generators including those in Asia, express their analytical data in terms of weight of nutrient and by weight of sample, for instance, ug/100g, mg/100g, g/100g edible portion depending on the concentration of each nutrient in the respective food sample. Among the 4 FCTs available in English at the ASIAFOODS regional Center, the Philippine FCT provides data of processed foods not only per 100 g edible portion but also per household unit. This type of data expression as well as those for fresh and cooked foods are in need of specialized users such as community nutritionists and epidemiologist for dietary assessment. The Malaysian FCT also gives information about serving size (in weight) of traditional cooked foods which could facilitate local users in assessing dietary intake.

TABLE 2: AVAILABLE NUTRIENT INFORMATION IN DIFFERENT FCTs IN ASIA

	China	Indonesia	Japan	Korea	Malaysia	Myanmar	Philippines	Singapore	Thailand
Main nutrient	o	o	o	o	o	o	o	o	o
DF			o(1)		(2)		(3)	o(1)	o(1)
Minerals									
Ca, P	o	o	o	o	o	o	o	o	o
Na			o	o	o		o	o	o(1)
K			o	?	o		o	o	o(1)
Mg			(2)	?			o		o(1)
Fe	o	o	o	o	o	o	o	o	o
Cu			(2)		(2)		o		o(1)
Zn			(2)		(2)		o		o(1)
Se	?		(2)		o				o(1)
I			(2)				o		(2)
Mn			(2)		(2)		o		
Vitamins									
Vit A	o	o	o	o	o	o	o	o	o
Carotene	o		o	?	o				o
RE			o		o				o(1)
Vit D			o						
Vit E			o		(2)				
Vit K									
Vit B1	o	o	o	o	o		o	o	o
Vit B2	o		o	o	o		o	o	o
Niacin	o		o	o	o		o	o	o
Vit C	o	o	o	o	o		o	o	o
Vit B6			(2)	o			o		
Vit B12			(2)	o			o		o(1)
Folate			(2)	o	(2)	o			
Panto.				o					
FAs	o		o	o	(2)		(3)	(2)	o(1)
AAs	o	o	o	o	(2)		o		o
Others									
Choles.	o		o	o	(2)		o	(2)	o(1)
Phytate						o	o	o	o(1)
Oxalate							o		
NaCl				o	o				
Total	19	14	26	>20	21	12	29	19	29

o : Nutrients included in FCT
? : Uncertain as to inclusion in FCT
(1) : Data available in published or unpublished papers, not yet included into the National FCTs
(2) : Data are being developed
(3) : Future plan for analysis

2.2 Language Used and Food Identification

Native languages are used in some of the national FCTs in Asia such as those of China, Japan, Korea, and Indonesia. International information exchange in these cases will be impossible unless they are translated into English. Presently, China is translating its FCT with assistance from the Institute of Cancer Research, the National Institute of Health, USA. On the other hand, Japan can only partially provide English data. Thailand's FCTs present part of "information to the users" in her native language, but nutrient composition data are presented in English. Malaysia and the Philippines present information to the users, names of foods together with the local names and nutrient data in English. Malaysia's FCTs are even more convenient since the English name is first presented, followed by the Bahasa Malaysia name.

Translation of local food names into English sometimes causes errors. In different parts of a country, colloquial food names may be different and can be misleading, which causes difficulties when translation is made. In addition,

some foods may have different names in different countries or regions, or different foods may even have the same name. Standardization of food names is a very tedious work, however efforts should be made, in cooperation with taxonomists of plants, animals, insects, etc., to correctly identify the analyzed foods. Photographs of specific local foods or food models would also assist in this process, though they have limited computer application. To facilitate data exchange for common food items, the nomenclature should be standardized by INFOODS in cooperation with counterpart members.

3. Availability of Related Information

Whenever an FCT is generated, it is essential to document carefully the factors involved which can and do contribute to the variability of the data. Users can then be made aware of potential problems surrounding the data, and they can judge for themselves as to whether or not the data are of sufficient quality for their use, or how they can work around the problems.

Regarding the availability of communication information in Asian FCTs, those of Malaysia and the Philippines are good representatives. The information given in their FCTs include:

1) Explanation notes on the FCTs
   - grouping of foods
   - nomenclature and description of foods
   - numbering of food items
   - source of data
   - methods of sampling and number of sample to be analyzed
   - methods of nutrient analyses
   - converting factor for protein calculation from nitrogen content
   - specific factor used to calculate energy
   - specific physiological energy factors for calculating the caloric value of foods (the Philippines's FCTs)
   - Recommended Dietary Allowances
   - abbreviation
2) Description of cooked foods which include
   - name of foods
   - serving size
   - ingredients
   - methods of preparation /cooking
3) Index of English names of foods
4) Index of native or local names of foods
5) Index of scientific names of foods
6) Bibliography

4. Computer Facilities and Systems in Asia

Ultimately, users need more than just data; they require the "hardware" and "software" to interact with these data. In several Asian countries (e.g., Japan, Malaysia, the Philippines, Thailand), computerization has assisted in decreased the time users require in painstaking, often routine, calculations, data generation, revision, compilation and management. This has also led to the more effective use of available data by a variety of users. The computer software are either self-developed or modifications of commercial programs such as FCODA (food composition data base system developed by the National Food Research Institute at Tsukuba, Japan), NUTRITIONIST III, FRAMEWORK, dBase III through IV, Foxbase, Lotus 1-2-3, etc. But the most important need is for a software "package" which is not complicated, flexible and allows the users to expand and revise nutritional information. It should also facilitate users in maximizing their ability to interact with available data.

RESPONSES, SUGGESTIONS AND REQUESTS FROM FCT USERS REGARDING DATA USAGE

Asian countries which generate their own FCTs via their own resources always use their own data. "Imported data" are used only for cross-checking their data when doubts about reliability or validity arise, or as source of nutrient information when the required data is missing in their own FCTs. Nonetheless, a number of problems are reported in using and comparing imported data in Asia. Some of the most important include the following, and, once again, these are not new problems. The presentation of users' responses to the problems are also included, however alternatives responses are expected from the group discussions at this conference.

1. Missing Data and Data Inconsistency

While data on some specific nutrients or data on newly manufactured foods and foods infrequently consumed are often missing from national food tables there is a major and crucial gap regarding the composition of foods as they are consumed. Specific to this problem is the issue of "raw" versus "cooked" foods

1.1 Raw Foods

Using data from imported FCTs whenever nutrien or food items are missing in the national FCTs is common answer from Asian users. The three mos frequently used FCTs (**Table 3**) are the USDA Agri cultural Handbook, McCance and Widdowson's *Th Composition of Foods* as revised by Paul and Southgate and FCTs for use in East Asia, FAO (1972). One mai

reason for using these FCTs is due to the English language presentation provided as well as their global distribution. Actually, using FCTs from neighboring countries is the most practical and desired, if the needed data are available and in English. Among FCTs available in Asia (**Table 2**), those of Japan, the Philippines and Thailand contain a greater amount of nutrient data (26, 29 and 29 nutrient items, respectively). Additional data regarding such aspects as dietary fiber, trace elements, and cholesterol are to be included in these national FCTs. In the mean time published data are available on request.

1.2 Cooked Foods

Missing national FCT information about cooked foods is another major problem encountered by users. As mentioned earlier, the nutritive value of cooked foods can vary greatly due to differences in the ingredients and raw materials used, size of raw material, methods of cooking, time and temperature used, etc. The best way to handle this problem is to gather representative samples of the cooked foods and assess them for the desired component. However, this option requires resources that users rarely have available. Therefore, most of the users compute the nutritive values of cooked foods by themselves as based on the nutritive value of raw ingredients that available in the FCTs. In order to gain more representative data by this option, careful step by step trials should be followed and appropriate considerations made in reporting the steps and standardizing data for computerization.

TABLE 3. INTERNATIONAL FOOD COMPOSITION TABLES USED AMONG ASIAN COUNTRIES

COUNTRIES	USDA	EUROPE	FAO	OTHERS
Brunei		o		Malaysia
China	o	o	o	
Indonesia	----------No information available ----------			
Japan	o	o		
Korea	o		o	NIH, Japan
Malaysia			o	
Myanmar		o	o	India
Philippines	---------No information available----------			
Sri Lanka		o	o	India
Taiwan	o		o	Japan
Thailand	o	o	o	Philippines, Japan, Malaysia Australia

USDA : USDA Agricultural Handbook
EUROPE : McCance and Widdowson's *The Composition of Foods*, revised by A.A. Paul and D.A.T. Southgate, 1978.
FAO : Food Composition Table for Use in East Asia, FAO, 1972.

Computation of "Raw" versus "Cooked" Foods

There are two ways to compute the nutritive value of raw versus cooked foods.

Method 1. *Calculation from Raw Food Recipes*

Step 1. Development of specific conversion factor to reconvert weight of cooked ingredients to raw ingredients. Different methods or conditions of cooking the same food contribute different conversion factors. This step is quite tedious, time and budget consuming. The factors also cannot account for the heat-labile nutrients, i.e., some vitamins. However, the conversion factors obtained are very valuable and can be used effectively to improve the quality of data in dietary assessment.

Step 2. Carefully weigh cooked ingredients of a representative dish to be estimated.

Step 3. Convert weight of cooked ingredients to raw ingredients using the specific conversion factors of specific ingredients.

Step 4. Calculate nutritive value of the cooked dish from available nutrient composition data of raw materials. The estimation of cooked food is then computed

Method 2. *Calculation from Computed Cooked Foods*

Step 1. Standardization of the ingredients by cooking the dish of interest several times. Each time the ingredients are recorded and average weight of raw ingredients as well as the obtained cooked food are estimated. If standard recipes of the interested dish are available, for example, from a dietary survey, by weighing method or from a standard cookbook, the weight of ingredients can be directly used.

Step 2. The estimation of nutrient composition of the cooked foods in a particular portion is then computed from the available data of raw materials in FCTs.

Step 3. The nutritive value of the same food (cooked) with different weights as consumed by a subject can be then estimated from the computed nutritive value of cooked food obtained in step 2.

Both methods are based on the assumption that there is a loss of only water during different processes of cooking or processing. However, in some foods especially fatty foods, not only water is affected by cooking, but lipid content and other nutrient may gain or loss. These methods cannot correct for the nutrients gained or lost by the process.

1.3 *Effects of Seasonal Variation and Planting Areas on the Nutritive Value of Foods as Arising from Inconsistent Data*

A question of whether seasonal variation as well as differences in planting areas affect nutritive value of foods is a major concern of users. These two areas arose since food composition data in international FCTs are often not consistent when compared to one another. At least in the first case, and possibly the second, this will affect the construction of FCTs and their ultimate cross-cultural utilization either through printed or computerized documents. Up to now, no data on these aspects is available in Asia.

2. Lack of Data Expression per Portion Size

In the process of a typical dietary assessment, a 24-hour recall method is used wherein the amount of food consumed by a subject is recorded as portion size using standard spoons or cups. Since most of the food composition data is expressed in terms of weight of nutrient per 100 g of edible portion, information on portion size is rarely given. Consequently, many users have difficulties in estimating the nutritive values from local and imported FCTs. Measuring the size of foods as well as weighing total and edible portions of a food sample prior to analysis by the generators is requested from the users. Nevertheless, using of a standard set of food models with known edible portions should be the right direction to this problem. The food models do not only help the subjects to recall how much food they have consumed, but they also help the interviewer in estimating the exact amounts of edible portions consumed. This in turn increases the quality of dietary assessment data.

DISCUSSION AND CONCLUSION

The problems encountered in the FCTs of differing Asian countries, as well as those associated with data imported from other sources, are not new problems; they were discussed in detail at an earlier 1987 conference report (7) as well as communications between ASIAFOODS network members. Yet each is a problem which must individually be corrected if good quality data is to emerge.

Mutual Awareness

People in Asia (including ASEAN) and many developing nations, who are working with the diverse aspects of food composition data, are not strongly aware of their efforts' similarities and the issues of which they must address. This has led to a persisting tradition of independent, non-coordinated activities resulting in the duplication of efforts, data incompleteness, and incompatibilities in data exchange. For many foods, only a limited number of nutrients have been analyzed, and data is still missing for many food items. In addition, many crucial data sets are scattered among institutions without any serious effort being made to compile them.

In not every case is this a problem. Where resources have permitted, data generation, the construction of adequate FCTs (e.g., Philippines, Malaysia), and to a small extent data exchange have progressed. Yet what is persistently missing is a sense of community within the field which would avoid problems of resource wastage and increase the likelihood of compiling more reliable international directories of food composition. Strongly recommended is the development of a mechanism for increasing awareness and cooperation among institutions and member countries within the field.

Limited Resources

To improve food composition data generation and compilation, all involved institutes require intensive efforts and resource use (e.g., time, manpower, finances). Very often, limited numbers of well-trained staff may be available for the required work programs. Yet since the latter are not "research-oriented", funding is difficult to obtain. These constraints can easily limit activities in up-dating and up-grading national FCTs in Asia. However, strong coordinated efforts could assist, to some extent, in overcoming these constraints.

Limitation of Standard Guidelines

Increased awareness exists regarding the need for a systematic program for generating, compiling and disseminating food composition data. Many standards and guidelines remain desperately needed in a number of areas if data exchange is to become a reality. Among ASEAN countries, for example, a draft INFOODS Manual, prepared by Greenfield and Southgate in 1987 (8) was distributed. This systematic guideline contains information of the production, management and use of food composition data, and it is often used by many ASEAN countries. Unfortunately, not all Asian countries have access to this guideline, largely because it is not a formal publication as yet. Nonetheless, use of such a guideline to effectively improve the quality, quantity and accessibility of food composition data is strongly recommended.

INFOODS Active Working Group

It goes without saying that the crucial leader in solving persistent problems in Asia and elsewhere is INFOODS itself. But the latter need not bear the entire burden. The construction of a **INFOODS *Active* Working Group**, comprised of key resource persons from each sub-network (e.g., EUROFOODS, OCEANIAFOODS, ASIAFOODS, NORFOODS, LATINFOODS), could assume this responsibility and work towards seeking support to correct some of the needs mentioned above, and which to one extent or another persist within each sub-network. Suggested activities for the Working Group are as follows:

1. The development of a standard questionnaire and the implementation of a survey on certain nutrient and food item data should be among countries within the region.
2. The formulation of a standard guideline for generating specific data, of special importance is cooked food.
3. Due to inconsistency in generated data, the working group could coordinate interlaboratory trials using an agreed upon procedure or guideline.
4. Another crucial area is the standardization of food nomenclature.
5. Provide guidelines as per the basic, necessary information to be included in national FCTs.

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