Paper 16

INTRODUCTION TO "NUTRIENT COMPOSITION OF MALAYSIAN FOODS, 1988"

by

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ABSTRACT

The systematic programme for the compilation of a Malaysian Food Composition Table has published a new and fairly comprehensive table. The 1988 edition of the table contains data (proximate composition, 5 minerals and 5 vitamins) for 783 foods, including 203 types of cooked foods. The paper commences by providing a background on the initiation of the programme and summarises the approach to the project, as well as, the methodologies used, including procedures for sampling food items for the study, and the analytical methods employed. The paper concentrates primarily on the explanation of the format used in the table, and discusses several aspects related to the use of the data. Explanations are also given regarding the grouping of foods, nomenclature and description of foods, and the system of numbering food items in the table. The significance of some of the nutrients tabulated is also discussed. Several aspects that need to be considered in using the data are emphasized. These include major factors affecting accuracy of the data, and the probable errors that may be associated with the use of these data. An understanding of these factors would enable more meaningful usage of the food composition data.

Although this programme has achieved an important stage of development, there is still much to be done to further improve the food composition database in the country. This include improvement of analytical techniques and quality of data, analysis of new foods in the market,and studies into other nutrients and non-nutrients that have not been given sufficient attention. The management of food composition data and related information need to be greatly improved for more efficient data storage, update and retrieval. It is hoped that with the continued support of all concerned, efforts towards achieving better and more useful food composition data can be continued.

INTRODUCTION

This paper introduces a new and fairly comprehensive Food Composition Table for use in Malaysia. This 1988 table is the result of a systematic analytical programme carried out in the last several years and all the data presented have been generated entirely by researchers in the country. When compared to the earlier editors of the tables published in 1982 and 1985, the present compilation has made several important improvements. Firstly, the new table presents data of more food items, totalling approximately 800. All of the foods tabulated have complete nutrient composition. Besides the data for raw and processed foods, composition for approximately 200 cooked foods are also presented. To facilitate users in searching for a particular food, three indexes have been provided, according to the common names, *Bahasa Malaysia* names and scientific names of the foods.

The paper provides a background on the initiation of the programme and summarises the approach to the project, as well as the methodologies used, including procedures for sampling food items and analytical methods employed. The paper concentrates primarily on explaining the format of the table, and discusses several aspects related to the use of the data. Explanations are also given regarding the grouping of foods, nomenclature and description of foods, and the system of numbering food items in the table. The significance of some of the nutrients tabulated is discussed. Several aspects that need to be considered in using the data are emphasized. Finally, some areas for future emphasis to further improve the food composition database in the country are highlighted. Through this paper, the Working Group for the Compilation of Malaysian Food Composition Table would like to share its experiences with its colleagues in the other member ASEAN countries. The Group would also like to contribute towards the success of the ASEAN Food Data Network.

BACKGROUND

A systematic programme to compile a comprehensive Food Composition Table for use in Malaysia was initiated in 1980. The first phase consisted of definition of the state-of-the-art of food composition studies in the country, and compilation of a preliminary table for immediate use in 1982 (Tee, 1982). In the second phase, systematic chemical analysis of local foods commenced, and was carried out as a collaborative programme between three institutions, namely Division of Human Nutrition of the Institute for Medical Research (IMR), the Food Technology Division of the Malaysian Agricultural Research and Development Institute (MARDI) and the Faculty of Food Science and Biotechnology of the Universiti Pertanian Malaysia (UPM). Financial assistance for the analyses was obtained under the ASEAN Protein Project, which was funded by the ASEAN-Australian Economic Co-operation Program (AAECP), and managed by the ASEAN Sub-committee on Protein. The fruit of this programme was in the form of an update to the preliminary table, published in 1985 (Tee, 1985).

The analysis and compilation programme continued for another four years into its third phase and terminating in mid 1989. Besides the three institutions mentioned above, the Department of Food Science and Nutrition of the Universiti Kebangsaan Malaysia (UKM) also joined in to tackle this huge and seemingly unending task. Continued financial assistance was obtained from the AAECP, under the ASEAN Food Habits Project and managed by the ASEAN sub-committee on Protein: Food Habits Research and Development. The climax of the programme is the publication of the Nutrient Composition of Malaysian Foods 1988 as presented in this workshop. Details of the background of the entire programme have been given in previous reports.

METHODOLOGIES

Project Protocol

The 1985 edition of the Preliminary Food Composition Table (Tee, 1985) was used as the basis for the analytical programme in the third phase of the Project (1985-1988). Foods with complete nutrient composition that were deemed suitable for use were carried over to the final database. Data for a total of 140 foods, mainly raw (unprocessed) foods from the preliminary table were thus retained. Those foods with minimally incomplete data (mostly minerals and vitamins), and for which similar samples could be obtained, were analysed for the missing nutrients. The majority of the foods with incomplete data were deleted and new samples obtained for analysis of the full range of nutrients. Various processed foods, including traditional foods were also identified for study. The cooked foods were almost all new analysis in the above mentioned period. For all categories of foods, the choice of foods for the study was mainly guided by their importance to the diet of local communities. All data presented in the table are solely from the four institutions participating in the collaborative analysis and compilation programme, namely Division of Human Nutrition of the IMR, Faculty of Food Science and Biotechnology of UPM, Food Technology Division of MARDI, and the Department of Food Science and Nutrition of UKM.

After the identification of the categories of foods to be studied in the analytical programme, the workload was shared by the participating institutions. Each institution was allocated specific food groups to analyse all the nutrients as tabulated in the table (proximate composition, 5 minerals and 5 vitamins). Results obtained were sent from time to time to the IMR for validation and entry into a micro-computer, making use of a programme modified from a commercial software. Print-outs were sent to the institutions for checking of correct data entry. If deemed necessary the analyses were repeated.

Within each group of foods, the items are listed in alphabetical order of the names of the foods.

Sampling Of Foods

Several sampling methods were practised, depending on various factors, including the nature and availability of the foods studied. For most of the raw foods studied, two samples of the foods were purchased from different outlets and each food with analysed separately, with analysis of each nutrient carried out in duplicate. In the case of processed foods, wherever possible, at least three different brands were obtained and a composite sample prepared for duplicate analysis. In all cases, mean values were calculated and reported.

For the cooked foods, a minimum of three samples were purchased from different outlets (restaurants or stalls, as the case may be) and analysed individually in duplicate. Mean values were tabulated for foods with identical ingredients and method of preparation.

Methods Of Nutrient Analyses

In the collaborative project for the Compilation of Malaysian Food Composition Table, the four participating institutions used a set of common methodologies compiled by the IMR. They are essentially AOAC methods (Williams, 1984), with modifications made by the IMR. Full details of each method are given in a manual which was recently updated (Tee *et al.*, 1987). Methods of analyses and expression of results for some of the nutrients are highlighted in the following paragraphs. Recovery studies, especially in the analysis of vitamins and minerals, were carried out for each batch of analysis, or as frequently as feasible.

FORMAT OF THE 1988 MALAYSIAN FOOD COMPOSITION TABLE

Grouping Of Foods

Nutrient composition of the foods are given in two sections. Section 1 gives the composition of raw and processed foods, while the composition of the cooked foods are tabulated in Section 2.

For the raw and processed foods in Section 1, these have been grouped according to the type or agricultural or veterinary produce. For each raw food commodity, the processed foods arising from it are listed immediately below it. The 14 food groups used are as given in the content page of this compilation.

For the cooked foods in Section 2, these have been separated into three groups. The first group in this section consists of various traditional Malaysian "cakes" (*kuih*), while various Malaysian meals and dishes are listed in the second group. The third group consists mainly of various Western type "fast-foods". Within each group, the foods are further grouped into various sub-groups, based on the main ingredients of the foods and dishes. The groupings are as shown in the content page.

Nomenclature And Description Of Foods

For each food item, the English name is first entered, followed by its *Bahasa Malaysia* name in italics, within brackets. Where appropriate, such as for the raw foodstuffs, this is followed by its scientific name in italics. An example of the format of entering names of a raw food is as follows:

Rice (*Beras*); *Oryza sativa*

Where the English name is not known, this is omitted, and the entry starts with the *Bahasa Malaysia* name, for example:

Mata kucing (*Nephelium malaiense*)

This method of entry is usually used for various local fruits and vegetables, as well as the traditional Malaysian *kuih* and dishes.

For food items where the *Bahasa Malaysia* name is unknown and when the foods are more frequently associated with other ethnic groups, their local names in Chinese or Tamil are entered. In the following example, the local name entered is in Chinese (Cantonese):

Kale, Chinese (*Kai-lan choy*); *Brassica alboglabra*

To assist in the identification of foods (especially raw foodstuffs), various textbooks were used. A list of the references consulted is given in the list of references in the table.

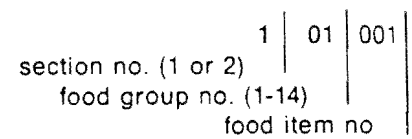
A description of the cooked foods is given in a separate section so as to assist users in identifying correctly the required data. This includes the portion or serving size, ingredients used and methods of cooking or preparation. The information tabulated is only a guide. Considerable variation can be expected for foods from different sources, especially for cooked dishes and meals. The item numbers listed, correspond to those used in the tables of nutrient composition.

Numbering Of Food Items

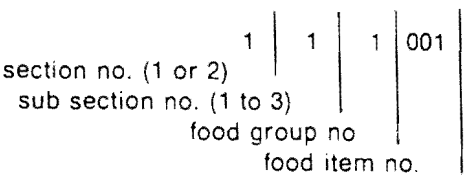
All food items are given a six digits identification number. For foods in section 1 (raw and processed food), the first digit is 1. The second and third digits of foods in section 1 refer to the food group number (i.e. 01 to 14), whereas the last three digits refer to the food item number. For foods in section 2 (cooked foods), the first is 2 followed by the second digit indicating the sub-section number (i.e. 1 to 3). The third digit refers to the grouping of the food according to its main ingredients. The last three digits refer to the food item number.

An example and explanation of a food in each of the two sections are given below:

raw and processed foods



cooked foods



SIGNIFICANCE OF SELECTED NUTRIENTS

Food Energy

The general factors of 4, 4 and 9 were used for calculating energy from protein, carbohydrate and fat, respectively. Hence, the accuracy of these data depends on the accuracy of the determination of these three nutrients. As will be discussed below, the determination of these nutrients themselves present various problems. It is thus clear that energy content as presented should be regarded as approximate values.

Protein

Protein content was obtained by analysis of total nitrogen and multiplying this by a specific factor suitable for the food. The factors used are as recommended by WHO (1973). A commonly used factor is 6.25, since most proteins contain 16% nitrogen. The protein values thus obtained are termed as crude protein, since the analytical procedure may include nitrogen from non-protein sources.

Carbohydrates

Carbohydrate values tabulated in this table have been obtained "by difference", that is by subtracting the sum of the concentration of moisture, protein, fat, fibre and ash from 100. In recent years the validity of such calculated values has been questioned, especially for carbohydrate-rich foods. Various methods have thus been proposed for direct analysis of carbohydrates or carbohydrates in foods. The required analysis can be rather complicated since carbohydrates in foods are complexed mixtures and knowledge on the chemistry of these nutrients are far from being complete. Nevertheless, several researchers in the country have embarked on the analysis of "available carbohydrates" in foods.

Crude Fibre

These values represent residues obtained after successive treatment of the food with acid and alkali to remove protein, fat and carbohydrates. The majority of these residues consists of cellulose, as well as hemicellulose and lignin. These compounds are various carbohydrate fractions in foods that are not absorbed and digested by man.

The usefulness of determination of crude fibre has also been doubted in recent years, since the values obtained may not give an accurate picture of the "unavailable carbohydrate" content of

foods. Greater emphasis has thus been given to the analysis of this portion of carbohydrates, also known as "dietary fibre", using more specific procedures. While attempts are being made to obtain these values for local foods, crude fibre values have been tabulated for tentative use.

Vitamin A Activity

Both retinol (vitamin A) and carotene (provitamin A) have been expressed as microgram (μg). Total vitamin A activity for each foodstuff was calculated and expressed as "retinol equivalents", abbreviated as RE in the tables. The United States National Academy of Sciences (1980) has defined the term "retinol equivalents" as:

1 RE = 1 μg retinol
= 6 μg β-carotene
= 12 μg other provitamin A carotenoids
= 3.33 IU vitamin A activity from retinol
= 10 IU vitamin A activity from β-carotene

Retinol equivalents of foods have been calculated as:

[ug retinol + (μg β-carotene/6)]

The assumption is that the carotene determined is β-carotene. It is now known that this is not so in many fruits and vegetables. The RE values presented are therefore probably overestimated for some foods and should be regarded as tentative. Efforts are being made to obtain more accurate data on vitamin A value of foods using more discriminative methods.

FACTORS TO BE CONSIDERED IN USING FOOD COMPOSITION DATA

An important factor that influences the accuracy of food composition data is errors associated with the analytical methods. The collaborative programme for the compilation of this 1988 table had attempted to reduce these errors by adopting a common set of methodologies for all the participating laboratories. In spite of this, it cannot be denied that several factors may cause errors and variations in the results obtained. Firstly, data quality control could not be carried out satisfactory due to the lack of biological standard reference materials. Such reference materials are expensive and not easily obtained. Besides, it was observed that slight modifications had to be made to the specified methods in order to suit various laboratory conditions or the nature of the food analysed. This resulted in variations to the analytical methods. Further, variations in analytical results were not adequately quantitated due to the lack of a system for inter-laboratory testing.

Several other factors have been known to give rise to larger variations than those that relate to analytical methods. These factors are related to the foods themselves, and include specie or cultivar differences, place of production of the food, agricultural practice, soil conditions, duration and condition of storage, and season of production (Bressani, 1983; Southgate, 1983). In order to take into consideration all these factors, more detailed tables are required, for example specialised tables for use in specific places, and tables that are frequently updated.

Most of the foods tabulated in this compilation are in the raw form, and various processes including washing and cooking have to be carried out before the foods reach the dinning table. These processes will result in losses of nutrients contained in the foods. If deemed necessary, data users may need to take into consideration the extent of nutrient losses.

Various other factors are associated with nutrient composition of the cooked foods. The ingredients, method of

preparation, and serving size of a particular food vary from place to place. In order to take into consideration these variations, efforts were made to obtain cooked foods from at least three vendors. The ingredients and method of preparation of each of the cooked foods analysed were also listed to assist the users in deciding if the data tabulated are suitable for his need.

Another factor that has to be borne in mind in the usage of the food composition data is the biological utilization of nutrients in foods. It has been known that the rate of utilization of several minerals and vitamins from plant foods is low. For example, the absorption of iron from foods of plant sources is considerably much lower than that from animal foods. The content of nutrients tabulated in the food composition tables do not take this factor into consideration. Prior knowledge of the biological utilization of nutrients from foods would enable more meaningful usage of the food composition data.

Considering the various sources of variations mentioned above, and the problems associated with food composition data generation, it is clear that such data only give a general picture of the "normal" level of the nutrient present in a particular food. These data should be used as in the case of recommended dietary allowances, that is for the evaluation of a particular aggregate in a whole system rather than individual (Stewart, 1983).

CONCLUSION

With the publication of this 1988 edition of the table, the systematic programme for the compilation of a Malaysian Food Composition Table has achieved an important stage of development. Laboratory analyses have been carried out under the various constraints and incurred considerable amounts of expenses. The shortage of man power for the required analysis has been an important constraint. Studies in this field have not been considered as particularly glamorous. They are however rather challenging as the amount of work involved is enormous and different problems were encountered with various food groups analysed. Moreover, these basic data are much required for various fields of research, food and nutrition practices, and demand for such data has been increasing. The Working Group considers the publication of this fairly comprehensive compilation as a success and hopes that it will assist researchers, and food and nutrition field workers in their activities.

In spite of the success thus far achieved, various short-comings exist for the data presented, as discussed in the previous section. Studies in this field will not terminate with the publication of the present table. With regards to the analytical methods, efforts towards improving the data generated will have to be increased. For example, greater awareness will have to be given towards the sampling methods and improved data quality control system. Variations in results obtained by the various laboratories will have to be quantitated more accurately. Studies into variation in nutrient content of foods from various places of production will have to be carried out.

Food composition tables will have to be updated from time to time. Research and development in the area of analytical methodologies are still advancing at a rapid pace, especially for minerals and vitamins. As improved methods become available, the contents of various nutrients will have to be re-examined. Analyses will have to be carried out on new food items, especially processed foods, being introduced into the market.

Besides these, the content of other nutrients in foods will have to be studied in the future. In recent years, the

importance of several nutrients that have not been tabulated in food tables have been given particular attention. These include fatty acid and amino acid composition, cholesterol content, several trace elements, such as selenium, manganese, copper and zinc, and several vitamins, such as tocopherol and folic acid. Most of these nutrients have been associated with several diseases, and the demand for knowledge of their levels in foods has been increasing. Interest on the concentration of non-nutrients in foods has also increased in recent years. These include several toxicants and food additives.

Not to be neglected are efforts towards more efficient management of food composition data. As the volume of composition data and other information on the foods analysed increases, the problem of data management becomes more acute. The Institute for Medical Research is taking steps to store the entire food composition database in the main-frame computer for more rapid and efficient data update and retrieval.

This discussion has given the impression as if work in this area will never end and the task quite impossible to accomplish. While it is true that there is no end to the analysis to be carried out, it is not an impossible task. What is required is a good start, and from there on, move ahead systematically step by step, towards a database that is more complete and that may be used more confidently. With the support of all concerned, studies towards an improved database will be continued.

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DISCUSSION

Roestamsjah : Should the food composition include also the typical recipes of the foods analysed?

Tee : In the table, typical or standardized recipes are difficult to obtain. This is due to the large variation in the so-called typical recipes. Hence, what the table has is the compromise of them i.e. the ingredients used in the cooked foods. Thus, caution must be taken when considering cooked foods with variations in the recipes.

Mahyuddin : The table is only a guide and we are aware about this problem.

Florentino : What are the criteria used for the choice of food items analysed? Secondly, what is the philosophy used in the sampling method?

Tee : The main criteria were based on the consumption pattern which has already been established. So, the choice of the food items is based on this information, as well as, feedback and requests from the general public. The sampling method used for the cooked food is controversial and difficult. In this project, variation in the cooked foods is minimised by obtaining samples from three different vendors at different locations. The results reported are then averaged out. For the processed foods, three different brands of a particular food product are analysed and composite sampling method is used. One constrain that limits the sampling method is the manpower and capability for analysis.

Edwards : Are you working towards standardising the methods for analysis of the nutrients throughout the ASEAN region?

Tee : For Malaysia, we are working towards a single method of analysis. However, there is a problem with mineral analysis due to limitation on the availability of instrument, such as atomic absorption. Therefore, there is a need to determine interlaboratory variation.

Kraisid : The programme on quality assurance of the food composition data in the ASEAN region is being conducted. The reliability of the methods used and the reproducibility of the data or results obtained is being acessed.

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