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Enhancing data on nutrient composition of foods eaten by participants in the INTERMAP study in China, Japan, the United Kingdom, and the United States

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Abstract

The International Study of Macronutrients and Blood Pressure (INTERMAP) is a four-country study investigating relationships between individual dietary intakes and blood pressure. Dietary intake patterns of individuals were estimated for macronutrients (proteins, lipids, carbohydrates, alcohol) and their components (amino acids, fatty acids, starch), as well as minerals, vitamins, caffeine, and dietary fiber. The dietary assessment phase of the study involved collection of four 24-h recalls and two 24-h urine specimens from each of 4680 adults, ages 40–59, at 16 centers located in the People's Republic of China, Japan, the United Kingdom and the United States.

For each country, an available database of nutrient composition of locally consumed foods was updated for use in the analysis of dietary data collected within the country. The four original databases differed in number and types of foods and nutrients included, analytic methods used to derive nutrients, and percentage of missing nutrient values.

The Nutrition Coordinating Center at the University of Minnesota updated the original databases in several ways to overcome the foregoing limitations and increase comparability in the analyses

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of nutrient intake of individuals across the four countries: (1) addition of new foods and preparation methods reported by study participants; (2) addition of missing nutrient fields important to the study objectives; (3) imputation of missing nutrient values to provide complete nutrient data for each food reported by participants; and (4) use of adjustment factors to enhance comparability among estimates of nutrient intake obtained through each country's nutrient-coding methodology. It was possible to expand, enhance, and adjust the nutrient databases from the four countries to produce comparable (60 nutrients) or nearly comparable (ten nutrients) data on composition of all foods reported by INTERMAP participants.

Keywords

Nutrient database; Food composition table; Dietary assessment; INTERMAP study

1. Introduction

The International Study of Macronutrients and Blood Pressure (INTERMAP) is a four-country study investigating intake patterns of various nutrients and their relationship to blood pressure. The study included participants from the People's Republic of China (PRC), Japan, the United Kingdom (UK), and the United States (US), with data collection from 1995–1999. The dietary assessment phase of the study involved collection of four 24-h recalls from each of 4680 men and women, ages 40–59, at the 16 centers located throughout the four countries (Table 1). Nutrients of interest to the study included energy nutrients and their components, minerals, vitamins, cholesterol, dietary fiber, and caffeine (Table 2). Protein, starch, fat, fatty acids, and cholesterol were related to primary study hypotheses, while the remaining nutrients related to projected exploratory analyses (Stamler et al., 2003). The final databases now contain 70 nutrient fields.

1.1. Database modification goals

Each of the four countries participating in INTERMAP adapted an existing nutrient database for analysis of dietary data within their country (Table 3). INTERMAP focused on relation of nutrients to blood pressure of individuals, with analysis plans related thereto, i.e., first for individuals by sample, then pooling of these data on individuals across samples, then across countries. Extensive updating of the four databases was required to meet INTERMAP goals of state-of-the-art nutrient data for these main analyses and descriptive data for comparative nutrient intakes within country and across countries (Dennis et al., 2003). Database updates increased comparability of the nutrient composition of foods consumed by study participants. Initially, the four databases differed in number and types of foods and nutrients included, analytic method or calculation used to derive nutrient values, and number of missing nutrient values. The Nutrition Coordinating Center (NCC) at the University of Minnesota was selected to modify the PRC, UK, and US nutrient databases used in the INTERMAP study in order to make the final analyses of dietary intake data as comparable as possible across all countries. The Japanese country nutritionist carried out modifications of the Japanese database with NCC reviewing the changes and methodology to assure consistency with methods used for the other databases (Okuda, Okayama, Choudhury, & Ueshima, 1997). Database modification goals were to (1) include all foods reported by study participants, (2) provide all nutrients of study interest, and (3) improve comparability of nutrient definitions and units of measure across countries. To meet these goals, NCC enhanced the databases with the addition of new foods and preparation methods, nutrient fields, and imputed values for missing nutrient data. In addition, adjustment factors were applied to improve comparability for those nutrient values or units of measure identified as being different among the databases.

1.2. Addition of new foods and preparation methods

The first step in modifying the databases was to add names and descriptions of foods used by participants in the INTERMAP study. The number and types of new foods added to each database varied by country (Table 4). For example, nearly 700 foods prepared by various cooking methods were added to the PRC database since few cooked foods were included in the initial database version. The Japanese database also required the addition of more than 800 cooked foods not included in the Standard Tables of Food Composition in Japan that was used as the original source of nutrient data. The UK and US databases already included cooked foods; therefore, for these countries foods to be added were often new commercial products appearing in the marketplace. In most instances new food descriptions could not be added to a database until data collection began and these foods appeared on the food recalls. The exceptions were the Chinese and Japanese cooked foods which were added prior to participant interviews since they were common foods prepared by cooking methods typically used and therefore likely to appear on the data collection records.

When a new food not included in the country's coding manual was reported on a dietary recall, a new food request was initiated at the local site. This process involved the site nutritionist investigating the nutrient composition of the new food and attempting to match it to an existing food in the database or to a combination of foods, as described elsewhere (Dennis et al., 2003). Many such requests were resolved on site and added to the country's coding system. Those that could not be resolved locally were sent to the country nutritionist and then to NCC, with a description of the food, the recipe or preparation method, and any manufacturer's information regarding nutrient and ingredient content. This information was used to generate a new food code that was then added to the appropriate country database. Some foods were not entered into the nutrient database at all, but rather data entry rules were provided to the country nutritionists on how the nutrient content of the missing food could be determined by coding it as a food or combination of foods already existing in the database. For example, one brand of yogurt might be coded as similar to an existing yogurt entry, or a fast food sandwich could be resolved as a "recipe" of meat, bun, and condiments. All of the US foods were done in this way and added to the dietary recall at the collection site using a recipe format in the data collection software (Schakel, 2001).

1.3. Addition of missing nutrient fields

None of the databases included all nutrients of interest to INTERMAP; therefore, missing nutrient fields were added to the country databases as required (Table 5). With the addition of these nutrients, the four databases contained most of the nutrient fields identified as important to the study (Stamler et al., 2003).

1.4. Imputation of missing nutrient values and yields

A complete set of nutrient values was determined for each of the foods included in the country databases. Some nutrient data, such as dietary fiber values for Chinese foods, were analytic values obtained from literature sources (Wang, Robertson, Parpia, Chen, & Campbell, 1991). Other nutrient values were imputed using the following standard methods (Schakel, Buzzard, & Gebhardt, 1997):

1. *Estimate from a similar food:* For some foods with missing nutrient data, values were derived from a similar food within the country database, from another country database, or from published literature sources. Similarities in the genus or family of a food; plant part, maturity, and color; processing and preparation; or meat cut were considered in selecting one food for estimation of nutrient values of another (Gebhardt, 1992; Rand, Pennington, Murphy, & Klensin, 1991). For example, the magnesium content of pumpkin flowers found in the USDA database (USDA, 1998b) was used for squash flowers in the PRC database since both plants are from the *Cucurbita* genus.

2. *Convert nutrient values for raw foods to cooked foods using yield and nutrient retention factors*: Application of yield and nutrient retention factors to raw foods was used extensively to generate nutrient data for cooked foods in the PRC database. In some cases, nutrient values of similar cooked foods from other sources were used directly in the PRC database. For example, the USDA nutrient database (USDA, 1998b) listed several types of uncooked rice, some of which have a nutrient content similar to Chinese raw rice; therefore, nutrient values/100 g of the corresponding cooked US rice were used for the prepared rice in the PRC database. Similar foods could not always be found in other data sources. In those cases, use of yield and nutrient retention factors obtained from literature or other databases were applied to nutrient values of raw Chinese foods (Ang, Searcy, & Eitenmiller, 1990; Bennink & Ono, 1982; Bratakos, Zafiropoulos, Siskos, & Ioannou, 1988; Cannell, Savell, Smith, Cross, & St. John, 1989; Gall, Otwell, Koburger, & Appledorf, 1983; Hutchison, Greenfield, & Wills, 1987a; Hutchison, Nga, Kuo, & Greenfield, 1987b; Nettleton & Exler, 1992; Piironen, Varo, & Koivistoinen, 1987; Slover, Thompson, Davis, & Merola, 1987; USDA, 1975, 1979, 1989, 1990, 1991, 1992, 1998a, b; Vaughn, Wallace, & Forster, 1987; Zurera-Cosano, Moreno- Rojas, & Amaro-Lopez, 1994). The following example illustrates how raw to cooked conversion factors for chicken meat from US data were used to estimate a nutrient for roasted duck meat in the PRC database: raw duck in the PRC database contains 2.2 mg iron/100 g; nutrient retention of iron in roasted chicken is 90% (USDA, 1998c); yield of roasted chicken is 68% (USDA, 1979); 2.2 mg iron × 90% retention = 1.98 mg iron/68 g cooked yield = 2.9 mg iron/100 g roasted duck.

   Yields for cooked foods were also added to the PRC database, since the quantity of food eaten by participants often was reported as the amount before cooking. For some foods, such as cooked rice or legumes, yield data from other countries were not appropriate for Chinese foods; instead, yield factors were calculated from changes in percent solids of the raw to cooked foods (Rand et al., 1991). For example, in the US database, 100 g of raw rice yields 307 g of cooked rice. When this yield factor was applied to the 28.2 g of carbohydrate in Chinese cooked rice, the result was 86.6 g of carbohydrate, more than the 77.7 g of carbohydrate provided by 100 g of raw Chinese rice (Table 6). Instead, a yield of 275% calculated by percent solids changes of the raw to cooked Chinese rice was used for the PRC database.

3. *Estimate from nutrient values of food ingredients:* Household recipes provided by country nutritionists were used to calculate nutrient values from ingredients of home-prepared foods. For commercial products, NCC developed formulations based on ingredient and nutrient information from the product label to determine food composition. The proportion of each ingredient in the product was estimated and then adjusted until the nutrient totals for the combined ingredients equaled the known nutrient values from the product label. For example, a ready-to-eat cereal from the UK contained wheat, sugar, oat bran, almonds, honey and salt as ingredients, along with vitamin and minerals added in fortification. A computer program (Westrich, Buzzard, Gatewood, & McGovern, 1994) was used to determine that the proportion of ingredients best matching the protein, fat, available carbohydrate, fiber, and sodium provided on the product label was approximately 37% wheat, 31% sugar, 26% oat bran, 3% almonds, 1.5% honey, and 1.5% salt. Values for nutrients not on the label were then calculated from these ingredients using the above percentages. The cereal label provided the levels of fortified nutrients/100 g that were used in the database.

4. *Calculate from a related nutrient*: Some nutrients are related and, if the value of one is known, the values of others can be calculated. For example, some vitamin A values were calculated from the beta-carotene equivalent and retinol data existing in the databases: vitamin A retinol equivalents (REs) = μg retinol+1/6 μg beta-carotene equivalents or vitamin A (IU) = μg retinol/0.3 +μg beta-carotene equivalents/0.6 (National Research Council, 1989). For the PRC database, vitamin E in alpha-tocopherol equivalents was determined from the biological activity of individual tocopherols: mg α-tocopherol + 0.3(mg β + γ-tocopherols) + 0.01 (mg δ-tocopherol) (Wang, Parpia, & Wen, 1992). For various meat cuts of the same animal species (e.g., beef sirloin and beef chuck), the same amino acid or fatty acid profile could be used after adjustment in proportion to the amount of protein or fat in the food (Schakel, Harnack, Wold, Van Heel, & Himes, 1999). Energy values were determined from protein, fat, carbohydrate, and alcohol and will be discussed later.

1.5. Use of adjustment factors for nutrient comparability

To compare nutrient data collected across the four countries, nutrient definitions and units of measure in the four databases should be uniform. Therefore, the final step in enhancing the databases was to adjust certain nutrient fields to increase comparability of values among countries. Nutrients that were similar enough in definition and units of measure to be compared without adjustment were protein, fat, alcohol, cholesterol, minerals, and most vitamins. Vitamin A, carbohydrate, fiber, and energy were not comparable either in definition or in unit of measure across the databases, and adjustments were needed to increase uniformity.

In some databases, vitamin A was presented in micrograms of REs; in others, international units (IU). Based on the retinol and beta-carotene equivalent fields, vitamin A was calculated in both micrograms of RE and IU in each of the four databases so that data analyses for this nutrient could be accomplished with either unit of measure. The equations used for calculation of vitamin A in IU or RE are found in Table 2.

Some databases included minor fatty acids in their saturated or unsaturated fatty acid totals, while these did not appear in other databases. When analyzing dietary intake data across the countries, only the fatty acids appearing in all four of the country databases were used in the sum of total saturated fatty acids or total unsaturated fatty acids (Table 2).

Both carbohydrate and energy fields required adjustments since values in the original databases reflected different ways the data were derived. The most difficult to adjust for comparability was carbohydrate. The INTERMAP investigators required carbohydrate to reflect “available carbohydrate”, i.e., to include starch and mono- and disaccharide sugars in gram weights, but not include dietary fiber. The PRC and Japan databases derived carbohydrate values “by difference” which included a deduction for crude fiber. The US carbohydrate values were also calculated “by difference” but with dietary fiber included as a part of total carbohydrate.

Carbohydrate in the UK database was determined by summing sugars and starch, but was reported as monosaccharide equivalents rather than gram weights. Therefore, to achieve more comparable values for available carbohydrate, each database was adjusted in some way:

1. (1) For China and Japan, dietary fiber, rather than crude fiber, was subtracted in the calculation of available carbohydrate “by difference.” Because dietary fiber was not included in the original PRC table, these values were added by NCC prior to recalculation of available carbohydrate. The original Japanese database contained dietary fiber, as well as crude fiber values.

2. (2) For the US, dietary fiber, present in the original database, was subtracted from the original carbohydrate values to obtain available carbohydrate. Since the US database contains values for mono- and disaccharides and starch, available carbohydrate also could be calculated by summing these values.

3. (3) For the UK database, sugar values were determined for all foods, and then sugar and starch amounts were converted from monosaccharide equivalents to gram weights (Holland et al., 1991) and summed.

These adjustments of carbohydrates in the four databases moved the values closer to the definition of available carbohydrates required by INTERMAP, although those calculated by difference may include other food components in addition to simple sugars and starch. Because the databases from China and Japan did not include fields for sugars, the method of totaling sugars and starch to obtain available carbohydrate could not be applied to these databases.

After completing the adjustment of carbohydrate, energy values were recalculated based on protein, fat, alcohol, and the new *available* carbohydrate values. Again the four-country databases originally used various methods for determining energy values (Table 7), and a decision had to be made as to which method would provide the most accurate estimate of energy intake. Energy values in the original UK database were determined using 4 kcal/g protein, 9 kcal/g fat, 7 kcal/g alcohol, and 3.75 kcal/g monosaccharide equivalents. According to Southgate (1995), “detailed evaluation of this approach in experimental studies on a large number of subjects showed it gave a good prediction of metabolizable energy intakes.” Therefore, a method that would approximate energy values determined by the UK method but with data available in the four country databases was desirable. To achieve similar energy values as those in the original UK database once the monosaccharide equivalents had been converted to gram weights (which reduces the amount of available carbohydrate in foods with disaccharides and starch), a factor of 4 kcal/g of available carbohydrate was used along with the 4, 9, and 7 factors for protein, fat, and alcohol respectively. In comparing values for foods in the UK database using the factor of 3.75 kcal/g monosaccharide equivalents versus the factor of 4 kcal/g available carbohydrate, the average energy values for 109 grain-based foods were 279 and 271 kcal/100 g, respectively; for 181 vegetable and legume foods, 58 and 56 kcal/100 g, respectively; and for 87 fruits, 66 and 69 kcal/100 g, respectively. Therefore, the factor of 4 kcal/g available carbohydrate provided a similar estimate of the energy value of foods and was applied to the available carbohydrate values for all four-country databases (Table 7). The energy factors used for INTERMAP databases are similar to those used for labeling of UK foods (Holland et al., 1991).

1.6. Unresolved database differences

With the enhancements and adjustments just described, database comparability was improved. However, some discrepancies remain. In calculating α-tocopherol equivalents as a measure of vitamin E, the conversion factor used for b-tocopherol differed slightly among databases. The PRC database combined β- and γ-tocopherols into one value and used 0.3 as the biological activity factor for the combined amount. Vitamin E calculated in the Japan database had an activity factor of 0.5 for β-tocopherol, while in the US and UK databases the factor was 0.4. α-Tocopherol equivalents could not be recalculated uniformly across the databases since not every database included individual tocopherol fields. Dietary fiber is also not fully comparable because across countries different methods of analysis were used. For the US, China, and Japan databases, the AOAC methods (Association of Official Analytical Chemists, 1995) 985.29 and 991.42 for fiber analysis were generally used; for UK foods, both the Englyst and Southgate methods were used in the original database (Englyst & Cummings, 1988; Southgate, 1969). NCC selected the Southgate values as most comparable to the AOAC in fiber definition (Deharveng, Charrondiere, Slimani, Southgate, & Riboli, 1999).

Other database comparability issues involved the way in which some nutrient values had to be imputed. For example, with limited data available, nutrient values from one country were sometimes used to impute missing data for a similar food in another country database. However, due to differences in cultivars, growing conditions, processing, and storage, these two foods may not be fully comparable in nutrient content (Rand, Pennington, Murphy, & Klensin, 1991). Even foods with the same brand name may have different formulations or fortification levels in two different countries. For example, Kellogg's Corn Pops sold in the UK has less folic acid than the product of the same name on the US market. The INTERMAP country nutritionists supplied NCC with data regarding fortification practices in their respective countries to prevent these errors.

Similarly, nutrient retention and yield factors from US foods often were used to calculate nutrient values for cooked foods. Again, these factors may not be fully accurate for preparation methods used in other countries. For instance, the amount of water used in boiling vegetables may differ between typical US practices and those in China and affect the retention of water-soluble vitamins and minerals.

2. Conclusions

Nutrient databases from four countries were modified to accommodate foods reported in the INTERMAP study and increase comparability in the analyses of nutrient intake of individuals across the four countries. Database modifications included: (1) addition of new foods and preparation methods reported by study participants; (2) addition of missing nutrient fields important to the study objectives; (3) imputation of missing nutrient values to provide complete nutrient data for each food reported by participants; and (4) use of adjustment factors to enhance comparability among estimates of nutrient intake obtained through each country's nutrient-coding methodology.

Our experience with INTERMAP provides an excellent example of the numerous and complex issues encountered in a multi-country study involving dietary assessment and nutrient analysis. Ongoing access to qualified and committed nutritionists from each country who provided detailed information regarding food descriptions and preparation methods was crucial to the success of the database modification project. Although the issues were challenging and the comparability continues to have limitations, particularly for some nutrients, it was possible to expand, enhance and adjust the nutrient databases from four countries to meet the research needs of the INTERMAP investigators.

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Table 1

Participant recruitment at INTERMAP field centers

Field center	Gender and age categories of participants				
	Men 40–49	**Men 50–59**	**Women 40–49**	**Women 50–59**	**Total participants**
People's Republic of China					
Beijing (rural)	67	66	70	69	272
Guangi (rural)	70	70	69	69	278
Shanxi (rural)	73	70	76	70	289
Japan					
Aito Town, Shiga	68	62	66	63	259
Sapporo	75	74	74	74	297
Toyama	72	77	76	74	299
Wakayma	73	73	75	69	290
United Kingdom					
Belfast	59	66	64	33	222
West Bromwich	74	67	66	72	279
United States					
Baltimore, MD	72	74	66	68	280
Chicago, IL	75	81	79	80	315
Corpus Christi, TX—Hispanic	69	66	73	67	275
Corpus Christi, TX—non-Hispanic	69	67	69	67	272
Honolulu, HI	67	69	66	65	267
Jackson, MS	65	67	68	66	266
Minneapolis, MN	65	65	65	65	260
Pittsburgh, PA	67	65	63	65	260
Total					4680

Table 2

INTERMAP nutrients

Nutrients	Calculations and inclusions
Energy nutrients	
Total calories	Calculated by 4 kcal/g protein, 9 kcal/g fat, 7 kcal/g alcohol, 4 kcal/g available CHO
Total protein	
Amino acids (18)	
Animal protein	Calculated by % of protein from animal-based ingredients
Vegetable protein	Calculated by % of protein from plant-based ingredients
Total fat	Includes triglycerides, phospholipids, sterols, and related compounds
Total Saturated Fatty Acids	Sum of 6:0, 8:0, 10:0, 12:0, 14:0, 16:0, 18:0, 20:0, 22:0
Total Monounsaturated Fatty Acids	Sum of 14:1, 16:1, 18:1, 20:1, 22:1
Total Polyunsaturated Fatty Acids	Sum of 18:2, 18:3, 20:4, 20:5, 22:5, 22:6
Total *trans*-Fatty Acids	Sum of 16:1t, 18:1t, 18:2t
n-3 Fatty Acids	Sum of 18:3, 18:4, 20:5, 22:5, 22:6
n-6 Fatty Acids	Sum of 18:2, 20:4
Individual Fatty Acids (20)	Undifferentiated fatty acids; includes all positional and geometric isomers
Individual *trans*-Fatty Acids (3)	16:1t, 18:1t, 18:2t
Total available carbohydrate	Calculated from (total CHO—dietary fiber) or from (sugars+starch).
Starch	Includes starch, dextrins, and glycogen
Alcohol	
Minerals	
Calcium	
Magnesium	
Phosphorus	
Iron	
Selenium	
Sodium	
Potassium	
Vitamins	
Vitamin A	RE: µg retinol + $\frac{1}{6}$ µg β-carotene equivalents IU: µg retinol/0.3 + µg β-carotene eq/0.6
Beta-carotene equivalents	µg β-carotene + $\frac{1}{2}$ (µg α-carotene + µg β-cryptoxanthin)
Retinol	
Vitamin E (α-tocopherol equivalents)	*US and UK*: mg α-tocopherol + 0.4(mg β-tocopherol) + 0.1(mg γ-tocopherol) + 0.01(mg δ-tocopherol); Japan: mg α-tocopherol + 0.5(mg β-tocopherol) + 0.1(mg γ-tocopherol) + 0.01(mg δ-tocopherol); China: mg α-tocopherol + 0.3(mg β-tocopherol + mg γ-tocopherol) + 0.01(mg δ-tocopherol)
Vitamin C	Includes L-ascorbic acid and dehydroascorbic acid
Other food components	
Cholesterol	

Nutrients	Calculations and inclusions
Caffeine	
Total dietary fiber	Includes soluble and insoluble dietary fiber

Table 3

Original nutrient databases for the four countries

People's Republic of China *(1)*	PRC Uniform Food Table, 1992
Japan *(2)*	Standard Tables of Food Composition, Fourth Revised Edition, 1982; Amino Acids, 1986; Fatty Acids, Cholesterol, and Vitamin E, 1987; Minerals, 1991; Dietary Fiber, 1992
United Kingdom *(3)*	Foodbase, Version 1.3, 1993; database software based on the 5th Edition of McCance and Widdowson's The Composition of Foods, 1991. Supplements to the 5th Edition of McCance and Widdowson's The Composition of Foods, 1992–1996
United States *(4)*	Nutrition Data System for Research, Version 4.01, Database Version 29, 1998

Source:

*(1)*China: Wang, G., Parpia, B., Wen, Z., (Eds.) (1992). *The composition of Chinese foods.* Institute of nutrition and food hygiene, Chinese Academy of Preventive Medicine, Beijing.

*(2)*Japan: The Resources Council, Science and Technology Agency of Japan (1982). *The standard tables of food composition in Japan* (4th revised ed.). Japan: Printing Bureau, Ministry of Finance.

The Resources Council, Science and Technology Agency of Japan (1986). *The standard tables of food composition in Japan, amino acids, revised.* Japan: Printing Bureau, Ministry of Finance.

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The Resources Council, Science and Technology Agency of Japan (1991). *The standard tables of food composition in Japan, minerals.* Japan: Printing Bureau, Ministry of Finance.

The Resources Council, Science and Technology Agency of Japan (1992). *The standard tables of food composition in Japan, dietary fiber.* Japan: Printing Bureau, Ministry of Finance.

Suzuki, Y., & Tanusi, S. (1993). *Table of trace element contents in Japanese foodstuffs.* Tokyo: Daiichi-shuppan.

*(3)*United Kingdom: Foodbase, Version 1.3 (1993). *The institute of brain chemistry and human nutrition.* London: The University of North London.

Holland, B., Welch, A. A., Unwin, I. D., Buss, D. H., Paul, A. A., & Southgate, D.A.T. (1991). *McCance and Widdowson's The Composition of Foods* (5th ed.). Cambridge, UK: The Royal Society of Chemistry and Ministry of Agriculture, Fisheries, and Food.

Holland, B., Unwin, I. D., & Buss, D.H. (1992). *Fruit and nuts. First supplement to the fifth edition of McCance and Widdowson's The Composition of Foods.* Cambridge: The Royal Society of Chemistry and Ministry of Agriculture, Fisheries and Foods.

Holland, B., Welch, A. A., & Buss, D. H. (1992). *Vegetable dishes. Second supplement to the fifth edition of McCance and Widdowson's The Composition of Foods.* Cambridge: The Royal Society of Chemistry and Ministry of Agriculture, Fisheries and Foods.

Holland, B., Brown, J., & Buss, D. H. (1993). *Fish and fish products. Third supplement to the fifth edition of McCance and Widdowson's The Composition of Foods.* Cambridge: The Royal Society of Chemistry and Ministry of Agriculture, Fisheries and Foods.

Chan, W., Brown, J., & Buss, D. H. (1994). *Miscellaneous foods. Fourth supplement to the fifth edition of McCance and Widdowson's The Composition of Foods.* Cambridge: The Royal Society of Chemistry and Ministry of Agriculture, Fisheries and Foods.

Chan, W., Brown, J., Lee, S. M., & Buss, D. H. (1995). *Meat, poultry and game. Fifth supplement to the fifth edition of McCance and Widdowson's The Composition of Foods.* Cambridge: The Royal Society of Chemistry and Ministry of Agriculture, Fisheries and Foods.

Chan, W., Brown, J., Church, S.M., & Buss, D. H. (1996). *Meat products and dishes. Sixth supplement to the fifth edition of McCance and Widdowson's The Composition of Foods.* Cambridge: The Royal Society of Chemistry and Ministry of Agriculture, Fisheries and Foods.

*(4)*United States: Nutrition Data System for Research (NDS-R) software version 4.01, developed by the Nutrition Coordinating Center, University of Minnesota, Minneapolis, MN, Food and Nutrient Database 29, released December 1998.

Table 4

Original foods in the country databases and new foods added

Database foods	PRC	Japan	UK	US
Total number of foods in the original database[a]	1455	1165[b]	3750	17000
New foods added to the database	802[c]	1766[d]	213	0
New foods coded as recipes or as similar existing foods in the database	0	88	9735[e]	766

[a]Not all foods in the database were selected by INTERMAP participants.

[b]1165 foods were selected to be included in the INTERMAP database from the 1621 food codes in the standard tables of food composition in Japan.

[c]Includes 681 cooked foods (only available as raw foods in the original database).

[d]Includes 804 cooked foods (only available as raw foods in the original database).

[e]Includes 76 foods added to the coding manual by NCC+9659 foods added by UK nutritionists.

Table 5

Nutrient fields added to country databases

Nutrient	PRC	Japan	UK	US
Animal and vegetable protein	X	X	X	
Amino acids			X	
Available carbohydrate	X	X		X
Starch	X	X		
Total dietary fiber	X			
Trans-fatty acids	X	X	X	
Selenium		X		
Caffeine	X		X	

Table 6

Variation in nutrient values of cooked Chinese rice using two yield factors

Intake of 100 g of raw rice is reported	
From the PRC database, 100 g raw rice; contains 8.0 g protein, 0.6 g fat, 77.7 g carbohydrate, and 348kcal	
Yield factor 1 Yield factor from US database: 100 g raw rice yields 307 g cooked rice	*Yield factor 2* Yield factor calculated by percent solids changes in Raw to cooked Chinese rice: 100 g raw rice yields 275 g cooked rice
From the PRC database, 100 g cooked rice contains 2.9 g protein, 0.2 g fat, 28.2 g carbohydrate, and 126 kcal	
307 g of cooked rice contains 8.9 g protein, 0.6 g fat, 86.6 g carbohydrate, and 387 kcal	275 g of cooked rice contains 8.0 g protein, 0.6 g fat, 77.6 g carbohydrate, and 346 kcal
Conclusion: Calculation of cooked rice nutrient values using yield factor 1 results in more protein and carbohydrate than is available in the 100 g of raw rice. Therefore, yield factor 1 is not appropriate for the PRC database; yield factor 2 is selected for the database	

Table 7

Adjustment of energy values

Country	Original method	Adjustment
PRC	General energy factors: (4 kcal/g protein+9 kcal/g fat+4 kcal/g carbohydrate+7 kcal/g alcohol)	
US, Japan	Specific energy factors by food category[a,b]	
UK	General energy factors: (4 kcal/g protein+9 kcal/g fat+3.75 kcal/g carbohydrate expressed in monosaccharide equivalents+7 kcal/g alcohol)	4 kcal/g protein+9 kcal/g fat+4 kcal/g *available* carbohydrate+7 kcal/g alcohol

[a]US—Atwater derived specific energy factors (Merrill & Watt (1973)). Energy factors account for potential food energy that can be absorbed and utilized and are specific to individual foods or groups of foods.

[b]Japan—The Resources Council, Science and Technology Agency of Japan (1982).