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EUROFOODS
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Eurofoods

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PREFACE

Working towards improvement and dissemination of food composition data in Europe

Eurofoods was formed by a group of interested scientists following a meeting in Wageningen, Netherlands in 1983 (*Annals of Nutrition and Metabolism*, 29 S:1 1985) which had identified a range of tasks to fulfil the objectives of improving compatibility of food compositional data and nutritional databases across Europe. The subsequent workshop in Norwich in the summer of 1985 provided a forum for reviewing progress and setting out new tasks for the future.

This report includes the papers, posters and reports of workshop sessions at the Norwich meeting. The papers have been extended to include significant material that became available after the meeting.

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EUROCODE

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Introduction

The need for a common food coding system has been recognized in the development of a proposal for a merged European food composition data base. Such a proposal provided an opportunity for the designing of a coding system which could assist nutritionists, dietitians, epidemiologists and food technologists in Europe in their international comparisons and in the referencing and sharing of the limited resources of available data on foods, their composition and their intake in various populations.

The coding system would aim to facilitate use of foreign tables and help bypass translational difficulties. It should be capable of assisting in food identification, encoding and searching for descriptive information. It should also enhance comparability of nutritional surveys within and between countries. Finally, it should aid in the exploration of associations between eating behaviour and disease risk.

Development of Eurocode

The first step in the development of a widely acceptable Eurocode was made through the development, circulation and discarding of successive drafts. In 1981 an expert group of the Federal Health Office in Berlin undertook the task of developing a standardized national food coding system for the Federal Republic of Germany. Some members of this committee believed that a standardized system would also be useful for Europe in general and began to draw upon the experience in developing a national code and extending this in a framework for Europe. The commission changed in profile and included members from Holland, Sweden, Denmark, France and Federal Republic of Germany. A first draft of the Eurocode was circulated in December of 1984 at a meeting at the European Community Headquarters in Luxembourg. Twenty-six main food groups structured in an alphanumerical strictly hierarchical form were suggested. The French representatives were influential in demolishing the idea of an alphabetical and English-based code. A new draft of a numerical code was circulated in January 1985 and discussed in detail at a three day coding workshop in February 1985 in Heidelberg. Twenty-seven individuals representing 15 countries attended and agreements on 14 major food groups was achieved. These can be found in Table 1. The draft was tested against national food table entries, difficulties documented and semantic problems overcome by person to person contact and extensive description. Subsequent to this workshop a meeting of the Federal Health Office Commission was held and the idea of a system with three separate components was put forth. This is described later. New drafts were circulated and responses from various groups were worked into a new draft put forth in May 1985 at a joint Eurofoods/Infoods meeting held in Heidelberg. Comments and critique between May and August 1985 were collected from a working group and discussed at a workshop at the Norwich meeting described later in this report. Since then two further rounds of exchange on minor details have been completed and incorporated.

Table 1. *Eurocode: primary food groups.*

1. Milk, milk products and dishes
2. Eggs
3. Meat
4. Poultry
5. Fish, molluscs, reptiles and crustaceans
6. Oils and fats
7. Grains
8. Pulses, seeds, nuts and kernels
9. Vegetables
10. Fruits
11. Sugar
12. Beverages (except milk)
13. Miscellaneous, soups, sauces
14. Foods for special nutritional use

The coding system

The current design for a coding and descriptor system involves two independent food codes and a standard set of variables for supplemental descriptions of foods. In diagram I the basic form of three components are illustrated. Code 1 is an unstructured sequential numbering of all foods available in Europe. Eurocode 2 is a semi-hierarchical, semi-informative code involving three to four fields of information for use in cross-referencing food groups between countries and bypassing translational problems. The agreed 14 basic food groups comprise the first field and a developing set of subgroups, the second field, of Eurocode 2. The third and fourth fields differ from country to country. Eurocode 3 will be a descriptor system, that is a set of parameters for completely describing foods or dishes (mixed foods), their characteristics and their methods of preparation.

Diagram 1. *Eurocode system design.*

CODE ONE		1, n + 1			non-informative, multilingual list of European foods with a unique code number
CODE TWO:					
field indiv.	1	2	3	4	
	main group	sub group	national items	variant	
CODE THREE:	A123, B24, C1, D47				Descriptor system, a set of variables considered necessary to describe a food for nutritional use

A - preparation
B - packaging
C - form

Eurocode 2

The Eurocode 2 component of the coding system is meant to provide in a food-group-oriented structure and a short numeric system a unique identifying code for each individual food, with no aggregation into generalized groups and no multiple code for the same food. Along with these premises (see table 2), the location of foods should be possible for persons without special nutritional, botanical or food technological knowledge. Flexibility for future expansion to include new foods and new food combinations is essential. The structure should avoid preference for any particular language or eating behaviour. The coding system must incorporate mixed foods, that is foods with more than one component into the main food group of their basic ingredient, not as a separate group of mixtures.

Table 2. *Premises for Eurocode 2. A practical code for intake assessment and table cross references*

1. Incorporating mixed foods integrally with natural foods or unprocessed foods (because the intake form is regularly as a mixture and many hypotheses are directed at the food as consumed).
2. A system in which the foods are easily located. A system whose usage does not require practical food knowledge (so that no extensive training in use is needed).
3. A code in which no detail in food identifying information reported by the subject is disregarded or aggregated (even if nutrient compositional data is not yet available).
4. A brief numeric code for each food (since alphanumeric systems show preference for a single language).
5. A system with only one code per food or dish. (The advantage for the coder is that there is no need to decide which one is which. An alphabetical index list will help with the problem of locating foods).
6. A food group oriented system to enable international food comparisons.
7. A code open for new developments in the food field as well as for new industrial products and for new botanical and zoological hybrids.

A food-group oriented structure was selected to support the desire that entries or typical intakes within a country be readily and exclusively aggregated into the commonly agreed upon major food groups. A short numeric system was chosen for aesthetic reasons and to avoid language preferences. Numeric systems for coding will also bypass the need for skilled typing in the food coding and entry process.

A unique identifying code for each individual food is foreseen, whether or not nutrient information is available, in an attempt to preserve information collected in national surveys instead of deciding in advance what foods or food groups are allowable and coding according to pre-arranged aggregates. No aggregation means that no information is lost in the coding process.

Multiple codes for the same food were also decided against. That is, mixed foods do not have two or more numbers, with positions in multiple food groups and subgroups. The reason for this is that it would confuse later comparisons of groups and make the programming much more complicated. The size of the code is also more compact with this option. The alternative decision would have extended the code endlessly. It would also have made the programming for cross-referencing multiple codes and combining intake information extremely tedious and inefficient.

Another advantage of a single code for food is that the coder does not have to decide under which code a given food will be indexed. And the potential complicating factor of the sum of intakes from food groups yielding more than the total consumed amounts is bypassed.

This particular code is designed for general use. It is not for specialists with specific technical knowledge. It is thought to be a usable resource for all individuals coding surveys, using intake studies or searching through foreign food tables.

A major problem in developing the code is the placement of mixed foods. The simplest solution is generally to put them in a separate group and avoid most of the effort of arranging them in primary food groups. However, within Europe they represent a major portion of foods eaten. Additionally, important physiological differences are to be expected between consumption of simple foods and mixed foods within the groups of their major ingredient. The design incorporates an identifying digit (a preliminary zero) to indicate mixed foods within a group.

These three to four fields are separated by a decimal point. The first field is one or two digits long, representing the numbers 1 to 14 of the agreed upon major food groups. The second field is one to five digits long, the first digit includes the zero in case of marking a mixed food-dish. The third field is a sequential numbering of items relevant within the subgroups to a certain survey or food table. Third field code values will differ from country to country. This is also true for the fourth field, which is used only in those cases in which variations of third field foods exist such as various recipes for the same dishes.

An example of its application for Hungarian Goulash would be 3.05.17.3. The 3 is for meat and meat dishes, .05 for pork dishes, and 17 standing for the 17th type of pork dish in the table of a particular country. The final three implies that three recipes or variations of this dish exist, and can be found in the recipe file.

Two design features have been incorporated to simplify food identification. One is a heading zero as a mixed food marker in the second field. All codes with zeros refer to foods which are composites of more than one basic food. The second is the systematic availability of codes in field two and three for designation of another similar food (code = 1) or an unspecified food of that group (code = 2).

As previously mentioned, Eurocode 2 is meant to enhance and facilitate the utilization of foreign food composition tables. Examples of three uses of the basic structure are the comparison of the distribution of foods in main Eurocode groups in various tables (Table 3), a comparison of food entries for a given subgroup in various tables (Table 4) and the comparison of the nutrient composition in different tables for the same food groups (Table 5).

Table 3. *Percentage distribution of foods, dishes and food products from various food tables according to main Eurocode groups.*

1.	Milk	8.0	10	10	6.8	8.6	11	6.1	11	9.2	5.9	5.4
2.	Eggs	0.8	1	1.6	0.5	0.9	1.8	2.3	1.5	0.4	1.2	1.7
3.	Meat	19	20	21	21	10	14	16	24	15	13	16
4.	Poultry	3.6	2.5	3.4	2.3	1.0	6.1	6.6	6.6	1.8	3.7	4.0
5.	Fish, molluscs reptiles, crustaceans	11	11	5.1	9.7	3.1	14	5.5	13	24	8.1	9.0
6.	Oils, fats	3.6	5.2	4.4	0.5	2.5	2.1	2.3	2.8	2.2	1.8	4.4
7.	Grains	7.4	10	4.1	19	12	13	12	10	4.4	10	14
8.	Pulses, seeds nuts, kernels	6	3.7	5.5	2.2	4.0	6.1	0.7	4.3	7.5	8.9	4.8
9.	Vegetables	15	14	16	14	14	15	15	6.9	12	13	10
10.	Fruits	8.6	11	10	7.3	7.0	8.0	10	8.0	12	13	14
11.	Sugar, sweets	2.8	3.5	4.4	5.3	6.0	4.0	5.6	2.9	3.5	3.5	2.8
12.	Beverages, (exc. milk)	7.2	5.8	9.9	5.1	7.3	4.5	8.5	7.2	4.8	12	5.4
13.	Misc., soups, sauces	6.4	1.2	4.1	2.8	10.9	1.1	4.7	1.7	2.6	4.7	6.3

14.	Special nutr. usage foods	0.6	0	0.2	3.3	11.1	0.3	1.8	-	-	0	0.4
n	of foods	503	649	435	393	1193	375	425	347	227	856	1100

The Eurocode 2 has been applied to 18 food tables from various countries, and the results stored on a multilingual food name database in Heidelberg. This coding has enabled comparisons of published tables in a number of ways. Three will be represented here: as mentioned above, the distribution of foods by main Eurocode groups; the utility of Eurocode in identifying which food items are available from which tables (Table 4); and use of the code for comparing the ranges of values for similar foods from different tables (Table 5).

Table 4. *Food entries from 15 tables for Eurocode 7.8 rice and 7.08 rice products.*

7.8: RICE GRAIN/MILLED PRODUCTS

DENMARK

RICE, FLOUR
RICE, PARBOILED, RAW
RICE, BROWN, RAW
RICE, POLISHED, RAW

FEDERAL REPUBLIC OF GERMANY

RICE STARCH
RICE HALF POLISHED
RICE UNPOLISHED
RICE POLISHED

FINLAND (AHOLA)

RICE, WHOLE-GRAIN
RICE, POLISHED
RICE, POLISHED BOILED
RICE, PUFFED

FINLAND (VARO)

RICE
RICE FEED MEAL
RICE, PARBOILED
RICE, POLISHED
RICE, PUFFED

FRANCE (OSTROWSKI)

GRAIN BROWN RICE
RICE FLOUR
RICE POLISHED

FRANCE (RENAUD)

RICE
RICE FLOUR
RICE RAW
RICE COOKED

GREECE

RICE WITH RAW

ITALY

RICE FLOUR
RICE POLISHED, ORYZA SATIVA

NORWAY

RICE STARCH
PARBOILED RICE
UNPOLISHED RICE
POLISHED RICE
PRECOOKED RICE

POLAND

RICE
RICE FLAKES GUICH
RICE PUFFED

PORTUGAL

RICE GRAIN
RICE FLOUR

SPAIN

SWEDEN

RICE PARBOILED
RICE PARBOILED COOKED
RICE BROWN COOKED

NETHERLANDS

RICE FLOUR
RICE, PARBOILED BOILED UNCLE BEN'S
RICE, SEMI-POLISHED UNPREPARED

UNITED KINGDOM

RICE, BROWN, RAW
RICE, BROWN, COOKED
RICE POLISHED RAW

RICE POLISHED	RICE, SEMI-POLISHED, AS THICKENER	RICE, POLISHED, BOILED
RICE POLISHED COOKED	BROWN RICE UNPREPARED	
RICE INSTANT = RICE PARTLY PRECOOKED	RICE, UNPOLISHED BOILED	
= RICE PARTLY PRECOOKED COOKED CA 5 MIN	RICE POLISHED UNPREPARED	
RICE PUFFED	RICE FLOUR INSTANT NUTRIX	
RICE PUFFED ROASTED	RICE BOILED	
7.08: RICE GRAIN/MILLED PRODUCTS		
DENMARK	FEDERAL REPUBLIC OF GERMANY	FINLAND (AHOLA)
FINLAND (VARO)	FRANCE (OSTROWSKI)	FRANCE (RENAUD)
	RICE PUDDING (RICE WITH MILK)	
GREECE	ITALY	NORWAY
	BISOTTE PESCATORA	
POLAND	PORTUGAL	SPAIN
SWEDEN	NETHERLANDS	UNITED KINGDOM
	RICE PORRIDGE RICE KRISPIES SPICED FRIED RICE BALL-DEEPER., PREP. FRIED RICE, IND. STYLE+MEAT-CAN/DEEPFR. FRIED RICE, IND. STYLE WITH MEAT AND EGG RICE MOUSSE JACKY	RICE KRISPIES EGG FRIED RICE FRIED RICE, OTHER THAN EGG

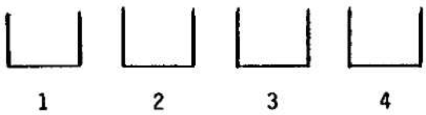
Table 5. *Nutrient values for the same foods from four different tables*.

EUROCODE	Foodname	Land	Sodium Na mg/100g	Potassium K mg/100g	Magnesium Mg mg/100g	Calcium Ca mg/100g
10.303.0	Apples	Netherlands	2.0	150	.	10.0
10.303.0	Apple	Finland	0.8	140	6.0	7.0
10.303.0	Apple	Sweden	1.0	110	8.0	7.0
10.303.0	Apple	FRG	3.0	144	6.4	7.1
10.303.1	Apple unpeeled	Netherl.	3.0	279	.	10.0
10.303.1	Apple dehydrate water: 2.5%	Sweden	7.0	730	22.0	40.0
10.303.2	Apples dried water: 24%	Sweden	5.0	569	22.0	31.0
10.303.1	Apple sauce - can or glass -	Netherl.	9.0	130	.	5.0
10.303.1	Apple puree canned	FRG	2.7	114	9.8	4.4

In Table 3 it can be seen that the most heavily represented food groups throughout Europe are groups 3 and 9: meat and vegetables. In the Spanish and Portuguese tables, the group of fish, molluscs, reptiles and crustaceans (group 5) are of primary importance. In the Finnish, the Dutch and British tables, grain products have among the greatest number of entries. To meet these specifications, the above described numeric code with two information fields, and two non-informational fields, was developed. Diagram 2 illustrates the code design. The relative scarcity of information on the components in foods (most tables and databases contain less than 2000 foods, whereas the available products number in tens of thousands) suggests that the search for a particular item has the chance of success. To enable the user of food tables to identify if the item sought, or something similar, is available in one or more of the 18 European food tables, before the effort undertaken to access foreign tables, and translate the entries in the search, a list of food entries in English and native language has been constructed by Eurocode 2 field 2 subgroups. A sample of this for rice and rice products (Eurocode 7.8 and 7.08) can be found in Table 4 for 15 European food composition tables. Here one will find where analyses of brown rice, polished rice, parboiled rice, puffed rice, rice flour and rice starch are available. The rice products in these food tables include mixed foods or dishes such as 'risotto pescatore', 'egg fried rice', 'rice mousse Jacky' and 'rice crispies'.

Finally, comparison of ranges of values for whatever reasons are important for food table users in the assessment of confidence intervals for the real nutrient value of a given food. Subgrouping similar to the previous example has been undertaken to compare mineral levels. This can be examined in Table 5, for the code 10.333; apples.

Diagram 2. *Code 2 design.*



1. Main Group (1–14)

2. Specific food at specie level/mixed dishes group

3. Sequential, nation specific list of items

(4. Variations of 3rd field dishes)

The current draft of Eurocode 2 is available on request from L. Arab.

Conclusion

A system has been proposed for merging and cross-referencing foreign food tables and foreign food intake surveys. Compromises were made and inconsistencies tolerated to guarantee general European acceptance of this system, and to keep it relatively simple. It is now hoped that organization of national food composition tables will be structured around these food groups and that intake surveys will store the information by Eurocode classifications to improve national and international comparability just as the ICD (International classification of diseases) has helped surveillance, monitoring and understanding of the etiology of diseases.

NLG PROJECT (Nutrient losses and gains in the preparation of foods) REPORT 1985

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Introduction

The Eurofoods NLG project was established in 1983 at the Eurofoods Workshop in Wageningen. The main task of the project is to collect data related to nutrient losses and gains in the preparation of foods so that factors can be recommended for use in the calculation of the nutrient content of the data bank recipes.

To approach this goal the work of the project has been divided into five subprojects; recipe calculation systems; recipes for ten dishes, analysed and calculated for energy and nine nutrients; NLG research; NLG references and NLG data base. The results achieved depend entirely on the participants' voluntary work as this project has proceeded without any funds.

Recipe calculation systems

Analyses of dishes are rather expensive but the composition of cooked food is needed, e.g. for research into different problems in human nutrition and for nutritional and dietetic treatment of disease. Therefore, calculation of recipes has been used for many decades. A tendency towards standardization of recipes was also noticed at an early stage (McCance & Widdowson, 1940) and standard methods for calculating these recipes were introduced, e.g. by using the percentages of ingredients included in recipes (Merrill, Adams & Fincher, 1966).

Recipe calculation for energy and nutrient content can be performed in several ways and at different levels, as follows: *(1)* on percentages of analysed raw ingredients in recipes; *(2)* on percentages of analysed cooked/processed ingredients in recipes; *(3)* on percentages of raw ingredients, either by calculation of yield for the whole cooked dish or using yield factors to adjust each raw ingredient weight to cooked one; *(4)* on percentages of raw ingredients, either *(a)* by calculating yield for the whole cooked dish, adjusting for water content (and fat content) and using NLG correction factors for the whole recipe, or *(b)* by changing the raw ingredients to analysed cooked ones using yield factors to adjust the raw ingredient weights to cooked ones or keeping the raw ingredients, correcting the weights for water, fat and fatty acids to cooked yield of the recipe and using NLG correction factors to adjust the nutrient content.

These NLG correction factors can be used in different combinations: for a nutrient in each food/ingredient of a recipe; for a nutrient in a group of foods/ ingredients of a recipe, and for a nutrient in the total food/ingredient content of a recipe.

Correction factors can be used at different levels according to cooking methods.

NLG recipe calculation systems on computer can be divided into the following three main groups.

1. Computerized NLG

Only ingredients of a recipe and the yield factor for cooked dish are entered into the computer and NLG correction factors are programmed.

2. Semi-computerized NLG

The ingredients of a recipe are calculated manually according to method 4, mentioned above, and/or the NLG correction factors have to be entered for each recipe.

3. Manually calculated NLG
The computer is used to calculate raw ingredients adjusted to yield of the cooked dish, and the nutritive values are corrected manually afterwards.

Table 1. *NLG recipe calculation systems in Europe, 1985.*

Country	Owner	Type of NLG System	Yields after cooking	NLG correction factors for					
				Proxi mates	Vitamins	Minerals	Ingredients	Groups of foods	According to cooking methods
Denmark	The National Food Agency of Denmark	Computerized	x		x			x	x
Federal Republic of Germany	Federal Research Centre for Nutrition Institute for Economy and Sociology of Nutrition	On computer Dishes calculated with yield factors for weight, energy and nutrients are included	x	x	x	x			X
Finland	The Department of Nutrition, University of Helsinki	Semi-computerized	x		x		x		x
Finland	The Rehabilitation Research Centre	Semi-computerized	x		x		x		x
German Democratic Republic	Zeutralinstitut für Ernährung	None							
Greece	Athens School Hygiene Dep. of Nutrition and Biochemistry	None							
Iceland	Icelandic Nutrition Council	None							
Norway	The National Society for Nutrition and	Manually	x		some				
Norway	Section for Dietary Research, University of Oslo	Semi-computerized	x		some				
Poland	Human Food and Nutrition Institute Dep. of Nutritive Value of Food	None							
Portugal	Institute Nacional de Saude	None							
Spain	Instituto de Nutricion (C.S.I.C)	Manually	x	fat	some				
Sweden	The National Food Administration	Semi-computerized	x		some				
Sweden	AB Felix	On computer	x						
Sweden	AB AIVÓ AB	On computer	x						
The Netherlands	Dep. of Human Nutrition Agricultural University	Manually	x	fat	some				

United Kingdom	MRC Dunn Nutrition Unit	Semi-computerized	x	x

The borderlines between these groups are not distinct.

As there are so many different ways of recipe calculation, it seemed important to invent the recipe calculation systems in Europe. Only one nutrient data bank owner's system seems to be completely NLG-computerized according to the above definitions and that is the Danish one. At least five countries have semi-computerized NLG systems in Europe. Five countries are NLG-correcting recipes manually and five countries have no NLG system at all. Two systems have only yields after cooking included (Table 1).

At many European laboratories cooked dishes are analysed for nutrients and the results are used as basic information in recipe calculation. Scientists of The Federal Research Centre for Nutrition in Stuttgart-Hohenheim have their own and others' research results in creating yield factors for energy and nutrients to be used in recipe calculation. The European recipe calculation systems have to be further investigated.

Recipe analysis, calculation and correction

Recipes for ten dishes were chosen: spinach soup, mashed potatoes, pommes frites, boiled rice, thin pancakes, roast beef, meat loaf, fried pork, roast chicken and fried cod fillet. People were asked to give information on ingredients and on nutrient content in analysed and calculated dishes. The main problem was that people usually have either analysed or calculated dishes, seldom both.

Dr Bognár in Stuttgart has, as mentioned above, been working on specific yield factors for energy and nutrients to be used in recipe calculation. This work is reported in Berichte der Bundesforschungsanstalt für Ernährung BFE-R--84-04. On the calculations collected Dr Bognár was to use these factors when recalculating the recipes and see if his calculation would be closer to the analysed values than without yield factors.

As the material is rather limited it is difficult at this stage to draw any conclusions. It seems though that the calculation is of less importance than other parameters, therefore calculation of standardized recipes will be performed as a next step and these results will also be compared to nutrient analyses of the dishes.

NLG research

For recipe calculation both food yields and nutrient correction factors are needed. An inventory of laboratories of different administrations, institutes, food industries etc. was compiled in an attempt to find people who are working on NLG and who are interested in collaborating with the project. In this inventory very few laboratories were reached.

NLG references

Laboratories might provide the NLG project with data directly, but there is also the indirect way to get information on nutrient losses and gains: through literature references. The project participants have sent in many references, especially Dr Singer, U.K. As Norfoods members have already collected NLG references it would seem practical to report all references in a joint Norfood/Eurofood publication.

European NLG data base

In order to store the references and NLG information a special NLG data base is needed.

At the Swedish National Food Administration the data processing unit has, in cooperation with the nutrition section, developed a model on behalf of Eurofoods NLG project.

Table 2. *European NLG data base questionnaire. Answers from eight individuals.*

Losses of different kind:		Nutrients to be reported:	
Fat left in pan	6	For foods both fresh and prepared/processed	
Drippings etc	6	Fresh weight	6
		Dry weight	6
Dry matter loss	1		
		In boiling water	6
		In drippings	6
		In left frying fat	6
Factors affecting nutrient content:			
Cooking/processing method	7		
Cooking time	7		
Cooking temperature	6		
Temperature profile [Temp=f(time)]	1		
Final internal/centre temperature	2		
Surface temperature in frying	1	Factors to be collected or created on information in the base	
PH	1	Yield factors for weight/edible part	
Pressure		Yield factors for nutrients and energy	
Volume-surface ratio	1	Retention or NLG factors in percent	
Processing parameters e.g. aerobic/anaerobic	1		
Changes during fermentation	1		
Are you 1n favour of a common European NLG data base?	7	*Comments*	
		Financial support is needed	2
Do you know any institute willing to host such a data base?	3 in FRG 1 in Spain	Difficult to prepare a common European NLG system as there are	1

1 in Sweden

<u>Which information should be included</u>?

References:			
Author	7		
Title	6	Analyses:	
Journal/book etc	6	Address of research institute	1
Year	7	Method of analysis	1
General information:		General information continued:	
Food/dish	7	Measurements of cooked ingredients included	1
Food group	6	Food yield by dishes	6
Amount food cooked in a study	7		
Raw ingredients	6	Amount boiling water added	7
		Amount frying fat added	6
Cooked ingredients	6	Type of fat added	1
Recipes of dishes with good description of edible portions and waste.	3	Amount salt added	7

The model is on the computer Nord 100 CX, using MIMER Quiry language, but the concept of the model may be transferred to any other computer and language. For developing the model to full scale, another language, e.g. ADA, and a very flexible database management system such as MIMER or ORACLE is needed for the storage and for the retrieval of the huge amount of data. The main purpose of the model is to collect data on nutrient losses and gains in the preparation of foods for creation of NLG factors to be used in computerized recipe calculation systems, but it can also be used as an extended nutrient data base system.

The model is now divided into different objects as foods (coded with Eurocode) with different *stages* and *processes; dishes, recipes; nutrients, nutrient groups; authors, articles* = *references, results* in the references and so on.

Cooking methods and processes can be divided into different procedures with physical, chemical and biological parameters included in order to structure and retrieve the data.

This model can be developed into a computer-based management system of nutrient losses and gains in the preparation of foods but other information can also be added, e.g. interactions between food and/or nutrients and, maybe, in the future bioavailability of nutrients.

Such a system could be used in several ways by people of different professions. German, Spanish and Swedish nutrient data bank owners might be interested in hosting such a base. The main problem is the financial one (Table 2).

Conclusion

It is of great importance that this NLG work should continue and also be extended to other countries. A well functioning recipe calculation system is needed, as many users of nutrient data banks are in the process of creating such systems. Now is the right time to recommend common NLG factors or a recipe calculation system for increasing the compatibility between different nutrient data banks.

For more information, please read the full report: NLG Project 1985 by Lena Bergström and Antal Bognár, available from the author.

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INFOODS-INTRODUCTION TO THE CONCEPT OF AN INTERNATIONAL FOOD DATA SYSTEM

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Introduction

Infoods was organized for the specific task of improving the amount, quality, and availability of food composition data around the world. It is coordinated by a secretariat based at the Massachusetts Institute of Technology in the United States, and supported by the United Nations University, the United States government, private foundations, and the food industry.

Infoods has three major aspects: it is *global*; it is concerned with the *availability* of food composition — including access, intelligibility, and suitability; and it is concerned with the *quality* of food composition data. Infoods is currently involved with setting up networks of people and data, and developing the guidelines and machinery to operate these networks.

Examples of needed guidelines follow consideration of the sequence from *food* to analytic *data* on composition to *database* or table to data *usage.* Thus, the data generators need to ensure that the necessary data are obtained correctly, the data compilers need to be able to supply the needed data when and where they are needed, in a usable form, and the users need to be able to obtain the data they need, and to be able to interpret them. Carefully formulated and documented guidelines are essential for global consistency and compatibility of such relevant activities.

In order to achieve its goals, Infoods is currently designed around a secretariat and three working groups.

Data quality

This group is addressing the problems of food composition data to ensure that the databases and tables are accurate, i.e. how data quality can be assessed and improved. David Southgate is coordinating this activity with the assistance of Heather Greenfield.

Terminology and nomenclature

This group is concerned with making food composition data universally intelligible, in terms of the names of the foods and nutrients, and also by recommending what additional information should be collected and made available. This activity is being directed by Stewart Truswell.

Information systems

This group, directed by John Klensin, is exploring how modern computer technology and information theory can best link food composition data and the users.

The secretariat coordinates the working groups in addition to carrying out other activities necessary to the task of improving food composition data. These activities range from preparation and distribution of a global directory of food composition tables to the forging of links between, and encouraging and helping to organize, regional organizations such as Eurofoods, which are concerned with food composition data.

In summary, Infoods is a global organization concerned with those aspects of food composition that are universal. It can only succeed if it is able to rely on strong regional organizations such as Eurofoods. The problems that are being faced are large. However, it is of a critical and growing importance that they be attacked and solved.

GUIDELINES FOR THE PRODUCTION, MANAGEMENT AND USE OF FOOD COMPOSITION DATA: AN INFOODS PROJECT

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Introduction

The Infoods (International Network of Food Data Systems) project to produce a set of guidelines for the production, management and use of food composition data was conceived at the Infoods planning conference held in Bellagio (Italy) in January 1983. The meeting agreed that many problems existed with food composition data worldwide. Data were scarce for many foods and many nutrients and those facts available were of uncertain quality. Moreover, there were difficulties in using existing data sets together because of their different modes of expression, different formats and different systems for food nomenclature. These problems posed significant constraints to the effective and accurate use of food composition data, giving rise to major barriers in carrying out and interpreting nutritional studies based on measurement of food intakes (Rand & Young, 1983).

The Infoods guidelines are based on Southgate's (1974) published guidelines for the preparation of tables of food composition which originated as a working paper presented at a meeting of the Group of European Nutritionists held in Zurich, 1972. This group was interested in national food composition tables and in the future possibility of a set of European food composition tables. Some years later Eurofoods has the same preoccupations, but with an emphasis on computerized databases as well as printed tables.

Work began on the Infoods project late in 1983 and a first draft was the subject of perusal and amendment by a group of experts who met at the invitation of Infoods in Washington in January 1985. The revised draft will be circulated to the IUNS Committee 1/10, 'Techniques for measuring the value of foods for man' (Chair: D.A.T. Southgate) and the IUFOST Commission on Food Safety and Composition (Chair: A.E. Bender). It is anticipated that the published manual will be available in 1987.

The Infoods guidelines have the following objectives: (1) to improve the volume and quality of food composition data; (2) to improve the comprehensiveness and quality of food composition data systems, and (3) to improve the compatibility of food composition data systems.

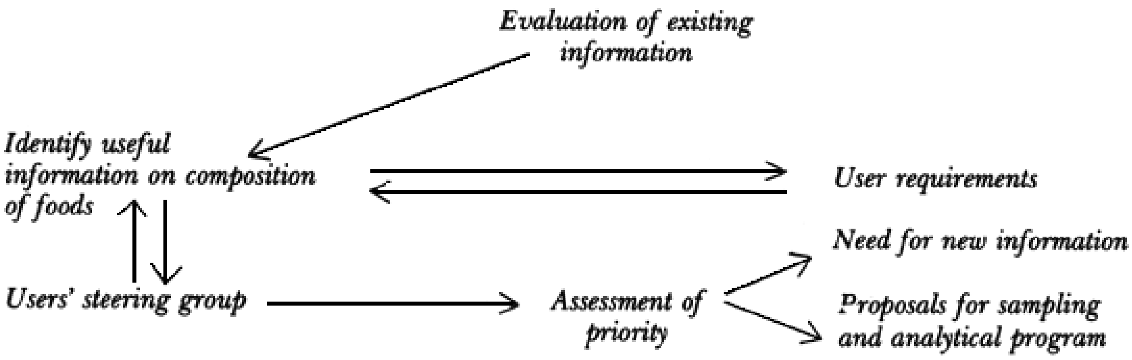
To meet these objectives the guidelines attempt to outline guiding definitions, principles, objectives and criteria in the production, management and use of food composition data, and also to outline the responsibilities of all concerned with such data, including policy-makers, managers and compilers of data systems, food analysts, educators and users. The guidelines are not standards since these cannot be imposed on individual nations or on individual scientists. It is expected, however, that the guidelines will be widely followed and that this common usage will result in a greater harmonization and compatibility of food composition data systems worldwide.

Table 1. *Areas covered by Infoods guidelines for the production, management and use of food composition data.*

• Initiation and organisation of a food food composition data system program	•Analytical methods
• The selection of foods for inclusion	•Quality assurance of analytical data
• The selection of nutrients for inclusion	•Format of a food composition data system
• Sampling of foods for analysis	•Use of a food composition data system

The text draws heavily on US and UK experience of producing and managing food composition data and on Australian experience of producing data for a national data system. The text follows all the steps involved in an ideal food composition data system program from the initiation of such a program through to the use of the database (Table 1).

Figure. *Stages of the data system program.*



Organization of a food composition data system program

The stages of an ideal program can be set out systematically (see Figure). This structure assumes that a body of information on the composition of foods consumed in the country or region already exists. This is the usual situation even in countries where there are no formal national tables of food composition. The first stage is therefore to examine this information.

Reviews of existing information

The information, both published and unpublished, is evaluated considering the information as data sources. It is then considered in relation to user requirements and provides indications of what new information is required. This in turn provides the basis for proposals for sampling and analytical programs. In most countries it will be necessary at this stage to define priorities and this will require further input from the users of the data systems.

Sampling and analytical programs

These programs need to be considered as an entity both from the viewpoint of data quality and also because the resources required for sampling and analysis need to be estimated together.

In developing the sampling plan, a considerable range of inputs is essential and the compilers need to consult widely. In many countries this stage involves assigning an element of the program to a contractor. If this is done it is essential that the compiler ensures that the contractor is aware of user requirements and the quality standards that have been set for data entering the system.

Sampling and analytical programs are most conveniently focused on specific foods or groups of foods. In placing contracts, focusing on specific food groups also defines the experience required in groups invited to tender for the contracts. Resource requirements will be determined by the proposed timescale for the work and logistical factors need to be considered very carefully. Once all these factors have been assessed it is possible to cost the different program sections and submit this for budgetary approval.

Supervision of analytical program

In principle, the concept of data quality should be built into the analytical procedures and the representation of the analytical interests on the Users' Steering Group will ensure that the analysts are aware of the detailed requirements of users. Nevertheless, it is useful to review analytical programs regularly throughout the work to reinforce the overall objectives of the analytical work, that is, the construction of a food data system.

Evaluation of analytical reports

The output from the analytical laboratory provides an input at the data source level and the values are subjected to initial evaluation ideally in discussion between compilers and analysts to ensure consistency in the data and to examine difficulties that arose during the execution of the work.

In practice difficulties are inevitable and often require those involved in sampling or analysis to respond rapidly and to depart from the formal protocols. It is vital that the compilers are fully aware of these changes.

Compilation of the data bank level

Once sufficient information has accumulated to compile the data bank it is desirable to initiate reviews by the Users' Steering Panel and by external specialists in a commodity or food group. The users' review serves two major purposes, first, it provides an assessment of whether the objectives defined by the users are being met and, second, it provides a means of managing the progress of the program.

The external review serves as a conventional peer-review and ensures that the data being acquired within the program are compatible with specialised knowledge for the commodity or foods (which may not be nutritionally orientated). Where proprietary products are involved it is desirable to submit the data to the manufacturer for comment. This will serve to identify inconsistencies in relation to the manufacturers' quality control data and to indicate whether the samples analysed were representative of normal production.

Compilation of the user database

Compilation refers to the management of data through the various levels of the data system, starting with the acquisition of the sources of the analytical values, the entry of values into the data system, the conversion of values to systematic modes of expression, the objective evaluation of values against a series of criteria, and finally the selection or amalgamation of values in the production of the user database. The compilation process is the point at which the direct analytical method and the indirect literature-based method of preparation merge (Southgate, 1974).

This requires close liaison between the Users' Steering Group and the compilers. A review by users of sections of the database as they are prepared is highly desirable. These reviews enable the compilers to bring to the attention of future users of the database problems regarding format, evidence of inadequate data, or that critical scrutiny of existing values has indicated the need for further analytical work. As the database nears completion pilot trials of its operation become desirable and these can be organized through the Users' Steering Group.

Operation of the database

Once the database comes into operation a series of operational studies are desirable. Although studies designed specifically to test the system are valuable the real tests come in regular use, and provision should be made to collect and collate experiences in use, e.g. particular difficulties or inconsistencies. Errors need to be centrally recorded so that the database can be corrected. Maintenance of the database needs to be seen as a continuous development leading to improved usage. It is also desirable to include some provision for periodic revision with a permanent Users' Group that considers extension and revision against the criteria used in initiating the program.

Quality of food composition data

This topic has been the subject of a review (Greenfield & Southgate, 1985) in which it is suggested that close attention to the following will improve the quality of compositional data: the procedure for obtaining and handling the food sample; the choice and execution of the analytical method; and the record-keeping process.

Quality of a food composition database

Clearly, the quality of the food composition data will determine the quality of the entire system. In addition, the process of compilation is the filter which ensures that, ideally, only good quality data reach the user level of the data system.

Type of values

Currently the types of values appearing in food composition data systems fall into four main groups.

1. Original analytical values

These are values taken from the published literature or from unpublished laboratory reports and include original calculated values, e.g. protein values derived by multiplying the nitrogen content (by analysis) by the required factor.

2. Imputed values

These values are estimated. They may be derived from analytical values obtained for a similar food (e.g. values for peas used for beans) or for another form of the same food (e.g. values for boiled used for steamed). They may also be values derived by calculation from incomplete or partial analyses of a food (e.g. any value derived ‘by difference’).

3. Calculated values

These are values derived from recipes by calculation from the nutrient contents of the ingredients and corrected for preparation factors (weight loss or gain or preparation; nutrient losses or gains during preparation).

4. Borrowed values

These are values taken from other tables or databases without reference back to the original source. It should be noted that these may be processed data and that currently few tables or databases are referenced adequately so that it is difficult to trace the source of the data.

It is expected that attempts to improve the quality of food composition databases will involve the gradual maximisation of use of original analytical data, refinement of other types of data (better calculations, more legitimate imputations) and elimination of borrowed values.

Criteria for an ideal food composition database

The compilation process will have the objectives of meeting the criteria which have been set up for the user database. These will vary from one to another but may contain elements of our proposed criteria for an ideal user database which are:

- the user should be able to rely on the values as a true reflection of the usual composition of the food and representative of the food as consumed or as available for consumption;
- the values should be high quality, accurate, original analytical data. Only in the absence of these should values taken directly from other databases, or produced by imputations or calculations, be considered;
- foods should be clearly and unambiguously named and described;
- the data should be unambiguous in mode of expression and systematic in the use of units, factors and rounding-off criteria;
- information should be given on the source of the data, whether analysed, calculated, imputed or borrowed, and, if analysed, on the methods of sampling and analysis. Confidence or quality codes for the values should also be given, where this is feasible (Greenfield & Southgate, 1985).

The data management process

To implement the compilation process correctly it is important to distinguish the different levels of data management which are listed in Table 2. The evaluation of data is an iterative process between these various levels with the compiler reviewing successively all the procedures used in the generation of the compositional values. Frequently questions will be raised at a higher level in the system (data bank or user database levels) which require re-evaluation of the data at the archival or data source level. It is thus essential that the evaluative process is fully documented throughout.

Table 2. *Levels of food composition data management.*

Level	*Description*	*Format*
Data source	Public and private technical literature containing analytical data, including published and unpublished papers or laboratory reports	As presented by original authors
Archival	Original data transposed to data files without amalgamation or modification. Scrutinised for consistency	One data set per original source to include details of origin and number of samples, sample handling, edible portion, waste, analytical methods and quality control used
Data bank	Data from all records for one food brought together to form the total pool of data	Common format
User database	Data selected; or combined to give mean values with estimates of variance for each food item	Common format

Table 3. *Suggested criteria for acceptance of food composition values**

Criterion	Increasing acceptibility			Unacceptable #
	3	2	1	0
Identity of food	Unambiguous	Unambiguous	Unambiguous	Any ambiguity
Representativity§ of sample	Indigenous, representative	Indigenous, but not representative	Foreign	Not stated
Nature of material analysed	Clearly defined	Clearly defined	Clearly defined	Not clear/not stated
Sample preparation	Described and known to be thorough and conservative	Described and known to be thorough and conservative	Described and known to be thorough and conservative	Not stated or known to be destructive or contaminating
Analytical method	Established, validated by collaborative trial	Established and accepted/ established, modified, modification described and seems adequate/new, but fully described and internally validated	New, fully described and seems adequate but not internally validated/ Established, modified but modification not described or described and inadequate	Discredited/new but not fully described or internally validated/not stated
Number of units analysed	10	3	1–2	N/A

Quality control	Analytical duplicates and recoveries of standards and recoveries from a matrix or SRM	Analytical duplicates and recoveries of standards	Analytical duplicates	Nil/not stated
Mode of expression	Units/factors clearly stated	Units/factors clearly stated	Units/factors clearly stated	Units/factors not given

* application of criteria may very from nutrient to nutrient and may be less vigorous where data are hard to obtain

any value rating O on any criterion should not be accepted into the databank

§ representative of food as consumed by the population

Evaluation of compositional data

An approach to the formalization of criteria for evaluating data and levels of acceptability for each criterion is shown in Table 3; the choice and application of criteria will, in actuality, be determined by those responsible for individual data systems. However, the need for considerable information at data source level is highlighted. The availability of this information is the responsibility of the analysis and may increase with closer collaboration between analysis and users and compilers of compositional data.

Entry of data into the data system

It is suggested that the entry of compositional values into the data system at the archival level be in a printed or magnetic format similar to that shown in Table 4. An archival file is required for each data source for each food, and should be fully annotated and documented to save frequent reference to the data source. Values are usually recorded in the same mode of expression as used in the data source.

Databank level

Scrutiny and evaluation at the archival data file level will permit values to be transferred to the databank which comprises the complete pool of data available on a food, from all the different sources. The values held at databank level will have been transformed to common modes of expression and will represent the different forms of the nutrient or component on an individual basis where these are available (individual vitamins, dietary fibre components etc).

Table 4. *Suggested format for an archival data file.*

Food name:
 Synonyms
 Systematic name
Reference to data source
Sampling protocol
Sample description
No. of units analysed

Constituent	Value	Method	Quality assurance
Edible portion			
Water			
Total nitrogen			
Protein (N × factor)			
Fat			
etc			

All of the information, ideally, will be coded and annotated to provide the basis for evaluation of the data at this level. Scrutiny of the data in the databank may bring to light discordant analytical values. In principle, all values should be included in the amalgamation of data to provide user database levels, but occasionally discordant values may be rejected because scrutiny indicates valid reasons for rejection such as a discredited method of analysis or inappropriate sampling handling procedures. The databank is represented schematically in Table 5.

The user database

Schematically, the derivation of the user database values appears at the base of Table 5. These values may be selected values (particularly where the pool of data is small) or averaged or weighted values where such amalgamations of data are considered valid. The user database may include summated or derived values for components such as total sugars, total dietary fibre and vitamin A activity where this format has been determined as appropriate.

Table 5. *Suggested format for databank for proximate composition**.

Food name	Food descriptors							Proximate composition			
Source†	Edible portion	Water	Nitrogen	Protein	Fat	Available carbo hydrate	Total dietary fibre	Ash	Energy	Notes‡	
Selected or averaged values											database values
Measure of dispersion											
Logic of selection or calculation											

* similar banks will be needed for other nutrient groups
† sources may be named or coded
‡ to include comments on quality of values, reasons for inclusion, signature, date etc

Table 6. *Confidence code for iron values in food.*

Confidence code	Meaning
A	The user can have confidence in the value
B	The user can have some confidence in the mean value; however, some questions have been raised about the value or the way it was obtained
C	There have been some serious questions raised about this value. It should be considered only as a best estimate of the level of this nutrient in this food.

From Exler (1982)

Indices of data quality

Exler (1982) has used a quality code to indicate the reliability of values appearing in a table of iron levels in foods (Table 6) based on the types of criteria used in Table 3. This concept could be adapted for use in other data systems, as a means of indicating the quality of values to the user.

Table 7. *Summary of the compilation process.*

Level	Summary of operations	Type of scrutiny applied	Format
Data source	Collection of sources containing compositional data on foods.	Analagous to review or refereeing of scientific paper. Check on consistency of data. Preliminary assessment of data quality.	In form published.
Archival file	Compilation of information into separate file for each food and each data source.	Scrutiny of data source against formal criteria. Tentative assignment of some measure of data quality.	In data system format. Recording details of sampling and analytical procedures.
Data bank	Compilation of information into file for each food item.	Comparison of values from different sources. Statistical calculations to identify discordant data. Rescrutiny of archival or data source. Calculation of statistical measures. Confirmation of data quality.	In data system format. Food item and array of nutrient values. Record of statistical measures and data quality.
Data base	Compilation of information for each food item in data base. Calculation of derived values.	Combination of values to give mean. median (or selected) value for each nutrient. Scrutiny of values for internal consistency. Rescrutiny of data bank, archival file and data source.	In format required by user.

Conclusion

Quality of food composition data and data systems has been discussed as an issue which is fundamental to the planning and organization of a data system program. Particular attention is drawn to quality assurance of analytical data and the appropriate evaluation of data in the compilation process (Table 7). However, in the final analysis it is the quality of usage of a food composition database which is important. This should be based on an understanding of the way in which data systems are constructed and thus on the uses and limitations of the systems themselves.

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INFOODS PROGRESS ON NOMENCLATURE OF FOODS

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'If a nomenclature is not correct, the thinking will not be logical. If the thinking is not logical, then work can not be successful.' — Confucius

Introduction

To prepare a terminology for international exchange it is essential to find out how compilers of food tables and users see their own terminology in many different countries and to listen to their reactions to any proposed system. There have been opportunities for listening to many different views at the Infoods meeting in Madrid in July 1984, in Heidelberg in May 1985, at the Brighton workshop in August 1985 and now at this Eurofoods meeting in Norwich (September, 1985). In between, Drs Rand and Klensin visited Sydney in September 1984 for discussions with me. Dr Rand established regular telephone conversations between Sydney and Cambridge, Mass. and in February 1985 we had a three day meeting at MIT with Will Rand, John Klensin, Ritva Butrum (NCI), Jean Pennington (FDA), Jean Stewart (USDA), Vernon Young, Nevin Scrimshaw and myself. We have had discussions with Dr Terry Leche, Secretary of INFIC (the International Feed Information Centre) and with Eurofoods as its coding system has developed.

Since January 1985 I have had a graduate research assistant, Kathryn Madafiglio, working with me in Sydney on Infoods terminology. I will look at six of our activities this year (1985).

1. Classification of Foods in Food Tables

When we reviewed the classification of foods in over 30 food tables from around the world we found three types of structures. Some food tables have clearly followed other earlier ones in their design. In general, food tables are evolving with time. There are good points and weak points in each. We found some excellent features in a few of the Third World tables which should be used more generally.

2. Infoods terminology

We have prepared a paper on the philosophy of Infoods terminology based on a meeting at MIT February 1985. The Infoods nomenclature and terminology system is being designed primarily to help communication between producers of analytical data and compilers of nutrient databases or national food tables. It does not have to be user-friendly for applied nutritionists in the field though ultimately it should improve the data available for them. It does not supersede or replace coding systems used in regional, national or specialized collections of food composition data.

Each time we eat a food or take a sample of it for chemical analysis or describe it, it is likely to be different in ways that can affect its composition in one way or another. This is a major premise of the Infoods terminology system. It is often assumed thatwe can find the perfect or typical form of each food. If we grow, process and cook a food properly and take enough samples and have them analysed by experienced chemists with the most accurate methods we can reach one best number for its content of different chemical components. This platonic, idealistic or dogmatic concept does not fit with modern biological science.

We take the empirical view. It is never possible to be sure that one sample of food is the same as another. This makes a code number or registration number misleading. Such a number implies an identity which does not exist. A registration number for a car means one car, the same shaped collection of metal and plastic. Any change to its structure is likely to be small. Another car could never have the same number unless there has been a legal or illegal transfer. An ISBN number for a book covers thousands of copies but they are produced by the printer in such a way that they should be indistinguishable. If he and his machines do their work properly each of the many thousands of words are in the same place on the same page in the same typeface.

Perhaps the nearest analogy to use of code numbers for present food tables is the numbers of the International classification of diseases (ICD). There is one number for (say) diabetes mellitus but all doctors know that the symptoms differ between patients with time and that there is a large range of possible values for the blood glucose. The ICD number is not used to predict the blood glucose value or the number and severity of symptoms; it is used for disease statistics, which for foods correspond to commodity consumption figures.

By using several words to describe a food sample we can improve the probability of predicting its chemical composition. The vitamin C content is affected by cultivar and by cooking so if we include these in the name or description of a food we are more likely to predict its vitamin C using food tables. Iodine content varies with the place where a food is grown so that if this is supplied with the name we can improve the chance of predicting iodine content.

Words are more suitable for our purposes of describing foods than numbers.

An international code number system for foods would also require an expensive registry. Delays in registration and allocation of numbers would be inevitable. Some scientists and some countries would not know about or not agree to or be too busy to communicate with the registry.

Hierarchial systems for classifying foods are not suitable for *international* exchange because:

(i) There are many more foods in the world than in national food tables. Some wild or bush foods haven't even been analysed yet.

(ii) Some animals or plants enjoyed in one country are considered disgusting, abhorrent, certainly not food in others.

(iii) In different cultures people see the relationships between foods in different ways. Even in the central countries where Western science is well developed there is disagreement about grouping and classification of foods. Should they be grouped on the basis of similarity of content of nutrients or on their use or following biological taxonomy? But for other purposes, e.g., cancer epidemiology, it may be more informative to group foods in other ways (type of wrapping, method of cooking, etc.)

Food composition data are being used today in many more ways than they were when the first food tables were compliled, originally to use in therapeutic dietetics. The decision to build a hierarchy for classifying objects is a decision about what is and is not important for ever. For international interchange none of the existing hierarchical systems for classifying foods are sufficiently flexible. This decision does not mean that hierarchical classification may not be very useful in national and even regional food tables.

The most practical approach is a multi-faceted naming system. The *facets* are independent. As in a diamond or a mountain there are different ways of looking at the object. There are several possible descriptors for each facet. The name thus is a series of *descriptors*, e.g..

- fried calves liver
- roast New Zealand Lamb
- Heinz baked beans
- sugared stewed cooking apples.

These four foods so briefly named require some six facets:- ORIGIN (calves, lamb, beans, apples), PART (liver), COUNTRY OF ORIGIN (New Zealand), MANUFACTURER (Heinz), ADDITIVE (sugar), CULTIVAR (*cooking* apples).

The International Feed Information Centre (INFIC) uses six facets:- ORIGIN (scientific name), PART, PROCESS, STAGE OF MATURITY, CUTTING and GRADE, For human foods three of the INFIC facets are of major importance (origin, part, process), two of minor importance (maturity and grade) and one not needed (cutting). Additional facets are clearly needed for human foods, such as a distinction between factory 'processing' and kitchen 'preparation'; manufacturer and brand name; container or wrapping; country where eaten and country of origin; list of ingredients.

Infoods has therefore adopted the principle of the INFIC system, as proposed originally by Ritva Butrum, but with more facets and some different descriptors.

3. Food groups

We collected details of food groups used in over 30 different food tables and systems.

4. Proposed food groups for Infoods

We produced for Infoods a new set of proposed food groups (*n*=44) which incorporates all the groups we had collected and eliminates the need for a miscellaneous group.

5. Nutrients and other components

Dr Southgate and I have thought of agreeing names of nutrients and other components as a much easier task than producing an agreed system for naming foods or agreed methods for analysing foods. There are already some international agreements about names of several classes of nutrients, e.g. amino acids, nutrient elements, and IUNS Committee 1/I has some rules for names of vitamins. Names of carbohydrates and fibre are in a more confusing state because of the different analytical methods being developed. Dr Southgate and I will meet the Infoods Executive during this meeting and a first draft of proposed Infoods names for nutrients will be circulated before the end of 1985.

6. Names of foods

We wrote a first draft of an *Infoods guide for naming foods* (April 1985). It was in the form of a questionnaire with a first set of 12 questions about names and country and use for the food. Before question 13 there was a branching, with different questions for single foods (scientific name, part, maturity) and for mixed foods (ingredients, recipe, reference). After four to six of these questions there followed seven common questions about processing, additives, cooking, and packaging. There were 23–25 questions in all. This guide was circulated before and very thoroughly discussed at the Infoods Terminology meeting in Heidelberg (19–23 May, 1985).

There were four sorts of comments and suggestions. (i) There were suggestions for *additional* information that would be interesting like a photograph or drawing, and a recipe file, etc. (ii) On the other hand some experienced participants warned that the guide might be *too long* (though six specimen descriptions were much shorter than the questionnaire. With abbreviations for different sorts of negative answers each took eight or nine lines of type). (iii) Questions about which languages could be used — e.g., any UN language or FAO language. (iv) Our proposed long set of food groups was not adopted.

To try and incorporate the suggestions at the Heidelberg meeting both for additional information and for a shorter list of facets the *Infoods guide for naming and describing foods* (July 1985) was written in time for presentation to the workshop at the International Nutrition Congress in Brighton and at this Eurofoods meeting in Norwich. In this there are optional and essential sections, like an income tax form. Everyone fills in some parts but whether you complete others depends on how you earn your money.

In this new guide the branching for additional descriptions of the food was into one of three possible types of food — single foods (no additions), mixed dishes (prepared in a kitchen of some sort) and manufactured multi-ingredient foods. In addition a last section was drafted about sampling (the bridge between the names of the food and the analytical data) for discussion with Dr David Southgate.

Thus the Infoods guide for naming and describing foods (July 1985) was made up in sections as follows:-

A. Sender's name, institution, address *or* literature reference.
B. Name of food: 12 descriptors to be supplied for every food: Names, local and international, scientific name, part, country, processing, cooking, manufacturer, brand name and lastly the food group and code number in the national food table, the regional food code and the Codex Alimentarius food classification.
C. Further descriptions. One of three parts to be answered: C.1 for single foods, C.2 for mixed dishes, C.3 for manufactured multi-ingredient foods.
D. User information — five optional pieces of information about who eats the food, in what portion size, how often, in what situations, etc.
E. Sampling procedures (ten questions).

As well as feedback from presentations at Brighton and Norwich we received some detailed postal comments from members of our Committee. The system for naming foods has been further modified and steamlined. We have gone back to two branches — single foods and mixed foods. Though the border between these is difficult to define the concepts of single versus mixed are less confusing and less computer space will be needed. Written in brief form (without instructions and explanations) *Infoods Nomenclature (October 1985)* is given in the Appendix.

Appendix

Infoods Nomenclature (October 1985)

[FF = Fixed Format, CV = Controlled Vocabulary, FT = Free Text]

SECTION A: Source of information (UN language)

1. Name of person sending data <FT>
2. Position of person sending data <FT>
3. Institution <FT>
4. Address <FT — this should be in the form of a complete mailing address — including country and country postal code>
5. Phone number <FF — ISO>
6. Date of transmission <FF>
7. Accession number; local bookkeeping number

SECTION B: Literature reference (may be multiple — first should be most important)

1. Form of reference <CV>
2. Standard citation (use Vancouver style) <FF/FT>
3. Address of publisher <FT>
4. ISBN/ISSN <FF>

SECTION C: Identification of food

1. Name of food in a national language and name of this language <FT>
2. Local name(s) of food and language for this name <FT>
   Complete the rest of the report in a UN language
3. Country where food consumed <CV>
4. Name of food in a UN language <FT>
5. Food group and code in national food table with reference <FT>
6. Regional food code(s) <FT>
7. Processing before purchase (in a factory, etc.) <CV>
8. Preparation or cooking method (in a kitchen) <CV>
9. Physical state/colour
10. Manufacturer and brand name <FT>
11. Container, wrapping, etc.

SECTION D: Additional Information on Food Branch to complete *either* D. 1. *or* D.2.

D.1.: Single food or major ingredient
1. Scientific name
2. Part
3. Country of origin
4. Other ingredients
   (include packing medium)
5 Maturity and grade (includes size)
6 Agricultural production details
7. Photograph or drawing — file No.
8. Storage conditions

D.2.: Mixed dish, several major ingredients
1. Standard culinary name
2. Ingredients
3. Recipe and/or cookbook reference
4. Where prepared

SECTION E: User Information
1. Frequency and time of consumption (annual)
2. Typical portion size
3. Usual user(s)
4. Intended purpose, if special
5. Where and how eaten

SECTION F: Data Gathering
1. When samples collected
2. Where samples collected
3. Sampling scheme
4. Weight(s) of sample(s)
5. Percent and nature of edible portion
6. Percent and nature of refuse
7. Handling between supplier and laboratory
8. Handling on arrival in laboratory
9. Laboratory storage
10. Reason for analyses.

SECTION G: Additional Information

MISSING VALUES IN EUROPEAN FOOD COMPOSITION TABLES AND NUTRIENT DATA BASES: Preliminary results of a survey

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Introduction

The usefulness of any food composition table or nutrient data base depends on the quality of the data used to construct it (Southgate, 1983). In general, original analytical data provides information of the highest quality. However in most countries, it is not feasible to construct a food composition table with only such data. Priorities for analytical work have to be drawn up and usually most effort is directed towards analysing foods which make a major contribution to the national diet. For specific individuals or groups, other foods may be of greater importance. Therefore it is necessary to estimate the nutrient content of foods rather than to have no data, which is usually represented by zero, in order to convert food intake to nutrient intake. As a result of the initial Eurofoods workshop held in Wageningen. The Netherlands in 1983 (West, 1985), a proposal for a project to collect data related to missing values in food composition tables was formulated. The main purposes of the project are as follows: (a) to determine which values are missing in food composition tables in the different countries of Europe and to obtain information on how the problem of missing values is being handled at the present time; (b) to analyse the information obtained and to bring about the exchange of data to enable missing values in tables to be filled; (c) to make suggestions on priorities for analysis of nutrients in those foods for which no data are available; and (d) to establish international guidelines for the estimation of missing values where no data are available.

In this report, preliminary results of a survey on missing values in 50 foods commonly consumed in Europe are presented.

Data collection

Participants

In 20 countries in Europe, the institutes responsible for compiling food composition tables were asked to participate. Replies were received from 13 countries, but it was not possible to evaluate the data from four of them. Thus the results of this survey concern food composition tables and nutrient data bases in nine countries (see Appendix 1).

Information requested

The study was based on a list of 50 ‘basic’ foods compiled by Mrs Lena Bergström (see Appendix 2). Information based on a further 50 foods commonly consumed in each country was also collected but the results of the analyses of these data will be presented in a subsequent paper.

Classification of nutrient values

Information on the type of values for energy and those nutrients most commonly included in current food composition tables (Appendix 3) were compiled by L. Arab (1985) together with the actual values. These were four categories, adapted from the proposal by Greenfield and Southgate (1985) as follows:

Original analytical values (type A): These values are taken from published literature or unpublished laboratory reports. This category includes original calculated values such as protein values derived by multiplying the nitrogen content by the required factor and “logical” values such as the content of cholesterol in vegetable products which can be assumed to be zero.

Imputed values (type B): These values are estimates derived from analytical values obtained for a similar food or another form of the same food. This category includes those derived by difference such as moisture and in some cases carbohydrate and values for chloride calculated from the sodium content.

Calculated values (type C): These values are those derived from recipes by calculation from the nutrient content of the ingredients corrected by the application of preparation factors. Such factors take into account losses or gains in weight of specific nutrients during preparation of the food.

Borrowed values (type D): These values are those derived from other tables or data bases without referring to the original source.

In classifying the data, four categories for values have been added. These categories are the following:

Absent values (type E): This category refers to the situation where there are no data available for inclusion in the table. Usually, these values are indicated by a blank, a dash or a question mark.

Values not included (type F): This category refers to the situation where the nutrient is not included in the table.

Unknown values (type G): The source of the value is unknown.

Mixed values (type H): This category has been introduced to describe values derived not only from other tables (borrowed values) but also from a limited number of original analytical data.

Data collection

Participants in the survey were asked to supply information either by filling in the questionnaire provided or by overscoring a computer printout of their food consumption table with one of four fluorescent marker pens sent with the questionnaire. In addition to the classification of the data and the nutrient values themselves, the following information was also sought: a complete description of the table from which the data were derived; the local names of the foods and the scientific names of the foods.

Results

The results of this survey show that not all the foods regarded as ‘basic’ were included in the various European food composition tables. The number of foods included varied from 34 in the Italian table to 50 in the Swedish table from which the list of foods was taken (Table 1). This result stresses the differences in food patterns in the various countries of Europe.

Table 1. *Proportion of original values for energy and specific nutrients for 50 basic foods in nine European food composition tables*

Country	*Number of*	*Proportion of data obtained from original analyses (referred to as type A data)*, %					
		Energy	*Total carbohydrates*	*Magnesium*	Iron	Retinol	*Thiamin*
Fed. Rep. of Germany	44	18	27	14	9	61	9
Finland	42	91	93	91	91	93[2]	91
Italy	34	88	50	0[1]	74	79[2]	82
The Netherlands	45	22	36	0[1]	24	22[2]	27
Norway	47	30	36	0[1]	45	45[2]	51
Poland	36	6	0	42	42	6[1]	42
Portugal	36	100	100	64	97	100	97
Sweden	50	32	30	14	42	84	34
United Kingdom	48	88	88	90	92	88	83

1) Not included in food composition table.
2) Expressed as retinol equivalents.

The frequencies of original analytical values varies not only between the tables but also for energy and important nutrients such as carbohydrate, magnesium, iron, retinol and thiamin (Table 1).

Portugal, Finland, Italy and the United Kingdom have a high proportion of original analytical values, while the tables from The Netherlands and the Federal Republic of Germany have only about 20 per cent of such values for energy and most nutrients.

Table 2. *Proportion of missing values for energy and nutrients for 50 basic foods in nine European food composition tables*

Country	*Number of foods listed*	*Frequency of the absence of data (referred to as type E data)*, %					
		Energy	*Total carbohydrates*	Magnesium	*Iron*	Retinol	*Thiamin*
Fed. Rep. of Germany	44	0	7	18	11	16	11
Finland	42	0	0	0[1]	0	0[2]	0
Italy	34	0	12	0[1]	12	6[2]	3
The Netherlands	45	0	0	0[1]	0	0[2]	0
Norway	47	0	0	0	4	2[2]	4
Poland	36	3	14	6	8	14	8
Portugal	36	0	0	36	3	0	3
Sweden	50	0	2	0	4	2	4
United Kingdom	48	0	0	0	0	6	6

1) Not included in food composition table.
2) Expressed as retinol equivalents.

Magnesium is not included in three tables and for the remaining tables, not many data are original analytical values. In general, for vitamins and minerals there are less original analytical values available than for energy, fat, protein and carbohydrate.

The proportion of missing values in the various tables for energy and specific nutrients for the basic foods (Table 2) indicates that different countries adopt quite different policies in constructing tables. For example, the aim in Portugal would seem to be to include only original analytical values and no calculated, imputed or borrowed data. On the other hand, Finland, the United Kingdom and The Netherlands have tables with few missing values. In the tables from Finland and the United Kingdom, the data are from original analyses while for The Netherlands, the data are derived from other sources (see Table 1).

Table 3. *The origin of the energy values for 50 basic foods in nine European food composition tables*

Country	*Number of*	*Proportion of data from various sources*, %					
		Original	*Imputed analytical value*	*Borrowed calculated value*	*Absent value*	*Source not known*	*Mixed value*
Fed. Rep. of Germany	44	18	2	9	0	0	71
Finland	42	91	2	7	0	0	0
Italy	34	88	0	12	0	0	0
The Netherlands	45	22	2	11	0	2	62
Norway	47	30	17	2	0	0	51
Poland	36	6	19	39	3	0	33
Portugal	36	100	0	0	0	0	0
Sweden	50	32	0	50	0	0	18
United Kingdom	48	88	8	0	0	0	4

The origin of the energy values for the basic foods is given in Table 3. Imputed and calculated values are grouped together because, from the information supplied, it was often difficult to distinguish between the two. The values for energy are calculated by applying the Atwater factors to the content of protein, fat and carbohydate. If the values for these proximate constituents in one food were of more than one type, the energy value for such a food was classified as “mixed”. As can be seen from Table 3, the German, Dutch and Norwegian food composition tables have many values of mixed origin. This can be attributed to the fact that in these tables, carbohydrates are often estimated by difference as follows:

Carbohydrate, g = 100g — weight in g of fat, protein, ash and water.

As can be seen in Table 3, many food composition tables have a relatively large proportion of borrowed values. When the original source of such data is not given, as is usually the case, it is not possible to evaluate the quality of such data. Sometimes, the values are based on high quality analyses, but the values can just as well be rough estimates. When constructing tables, it is very important to state the source of the data. The problem becomes more acute when tables go through a series of revisions because often it is just said that a value has been taken over from a previous edition of the table and the true origin of the value becomes lost.

Conclusion

The results of this study give a general impression of the quality of data in the various European food composition tables examined. It is only an impression because the 50 ‘basic’ foods did not appear in all of the tables. The data quality, as expressed by the proportion of original analytical data, varied between the tables and also within the tables with respect to different nutrients.

When the results of the second part of the study, involving 50 of the most important foods in each country apart from the 50 'basic' foods mentioned above, become available this will provide further information on the quality of data in the various tables.

References

Arab, L. (1985): Summary of survey of food composition tables and nutrient data banks in Europe. *Ann, Nutr, Metab*, **29,** Suppl. 1, 39.

Greenfield, H. and Southgate, D.A.T. (1985): A pragmatic approach to the production of good quality food composition data. *Asean Food J. 1*, 47.

Southgate, D.A.T. (1983): Availability of and needs for reliable analytical methods for the assay of foods. *Food and Nutr. Bull*, **5,** 30.

West, C.E. (ed) (1985): Eurofoods: Towards compatability of nutrient data banks in Europe. *Ann. Nutr, Metab.* **29,** Suppl. 1, 72pp.

APPENDIX I

List of food composition tables and nutrient data bases studied (Contact persons are given in parenthesis).

1. Federal Republic of Germany.
   Souci-Fachmann-Kraut (1981): *Die Zusammensetzung der Lebensmittel.* 2nd edn. Stuttgart:
   Wissenschaftliche Verlagsgesellschaft (Ms. B. Meyer, Dr. H. Scheun, Dr. A. Bognar).
2. Finland.
   Turpeinen, O., Ruoaka-ainetaulukko, A. ed (1983): *Finnish food composition tables* Keuruu:
   Otava (Ms. M. Ahola).
3. Italy.
   Carnovale, E., Miuccia, F. (1976): *Tabelle di composizione degli alimenti.* Roma: Istituto Nazionale della Nutrizione. Ministero dell'Agricoltura e Foreste, (Dr. E. Carnovale).
4. The Netherlands.
   Extended Dutch food composition tables. Commissie UCV, (1985): *Uitgebreide voedingsmiddelen-tabel* 3rd edn. Voorlichtingsbureau voor de Voeding. 's-Gravenhage, (Miss B. Meyer, Ir. B. Breedveld, Mrs. W.G.M. Boeijen).
5. Norway.
   Norwegian national food composition tables, Matvasetabel (1984): 5th edn. Oslo: National Society of Nutrition and Health (Mrs. A.H. Rimestad, Mrs. E. Bjørge. Løken).
6. Poland.
   Polish food composition tables, Piekarska, J., Los-Kuczera, M. (1983): *Sklad iwartose odzycza produktow spozy czych.* Warsaw PZWL, (Dr. B. Kowrygo).
7. Portugal.
   Portugese food composition tables. Conclaves Ferreira, F.A., Da Silva Graca, M.E. (1977):
   Tabela de composicao dos alimentos Portugeneses. 3rd edn. Lisbon: Ministry of Health and Assistance, (Dr. I. Martins).
8. Sweden.
   Swedish food consumption tables. Statens livsmedelsverk (1981): *Livsmedelstabeller: energi och vissa naringssammen* 2nd edn. Uppsala, (Mrs. L.

Bergström)..

9. United Kingdom.
McCance and Widdowson's: *The composition of foods.* 4th revised edition by Paul, A.A. and Southgate, D. A. T. Medical Research Council and Ministry of Agriculture and Food, Her Majesty's Stationery Office (Miss A. Broadhurst, Miss A. A. Paul).

APPENDIX 2

List of 50 'basic' foods examined

1) Apple, raw
2) Banana, raw
3) Orange, raw
4) Orange, juice
5) Cabbage, white, raw
6) Carrots, raw
7) Peas green, deepfrozen
8) Potato, raw
9) Tomato, raw
10) Bread, white
11) Cornflakes
12) Oatmeal, raw (rolled oats)
13) Pasta, raw (macaroni)
14) Rice polished, raw
15) Beef minced, raw
16) Chicken, raw
17) Liver, calf, raw
18) Pork chop, raw
19) Ham, canned
20) Coffee, beverage
21) Tea, beverage
22) Cola
23) Beer
24) Wine, red ordinary
25) Cod, raw
26) Salmon, raw
27) Plaice, raw
28) Tuna, canned in oil
29) Mussels, canned (excluding liquid)
30) Butter
31) Lard
32) Corn oil
33) Mayonnaise
34) Margarine
35) Cheese, firm, (Cheddar, Emmentaler)
36) Cheese, cottage
37) Cream, coffee, lowest fat content
38) Milk, fat content ca. 3%
39) Eggs, whole, raw
40) Almonds, sweet
41) Coconut flesh, dessicated (if not available, fresh)
42) Hazelnuts
43) Peanuts, roasted and salted
44) Walnuts
45) Sesame seeds, decorticated
46) Chocolate, dark
47) Honey
48) Marmalade, orange
49) Sugar, white
50) Syrup, light (golden syrup from sugar beet/cane)

APPENDIX 3

Energy and nutrients included in the evaluation

- Energy
- Protein
- Total fat

Total sfa (saturated fatty acids)

- Total ufa (unsaturated fatty acids)
- Total pufa (polyunsaturated fatty acids)
- Linoleic acid
- Cholesterol [1]
- Total CHO (carbohydrates)
- Starch
- Dietary fibre
- Total sugars (= mono- and disaccharides)
- Alcohol
- Sodium
- Potassium
- Calcium
- Magnesium
- Phosphorus
- Iron
- Zinc
- Iodine
- Retinol
- β-carotene
- Vitamin E
- Thiamin
- Riboflavin
- Nicotinic acid (Niacin)
- Vitamin B_6 total
- Ascorbic acid

SUMMARY OF THE EUROFOODS INTERLABORATORY TRIAL OF NUTRIENT ANALYSES

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The Eurofoods interlaboratory trial 1985 was set up to determine whether differences in laboratory procedures between countries form an important cause of discrepancies between nutrient values in different food tables and nutrient data banks. Twenty leading laboratories in Europe and the U.S.A. participated in the trial. Each received a well-homogenized dry sample of 100 g of egg powder, full-fat milk powder, whole rye meal, whole wheat meal, biscuits and French beans. Heterogeneity between samples of the same food was checked by analysis of nitrogen in 10 random samples of each food, and was found to be negligible (coefficient of variation 0.1–0.2%). Each laboratory was requested to perform analyses of dry weight by a prescribed vacuum stove method, and of protein, fat, available carbohydrates, total dietary fibre and ash by its own routine method. Analyses were made in duplicate, with two technicians each contributing one value. All results were later recalculated to dry weight to eliminate the effect of losses or gains in moisture.

— For dry weight, the coefficient of variation between laboratories ($CV_{between}$) ranged from 0.3–0.6%. Optional non-vacuum methods yielded results quite similar to those of the prescribed method.

— For protection the $CV_{between}$ ranged from 2.8% for egg to 6.4% for wheat and rye. Recalculation using uniform Kjeldahl factors reduced these CV's to 2.7, 4.7 and 5.2% respectively. Reproductibility within laboratories was occasionally poor.

— The $CV_{between}$ for total fat ranged from 5.4% for milk to 54.0% for french beans, the CV being higher when the absolute fat content of the food was lower. The reported fat content of egg powder ranged from 29 to 44 g/100 g dry weight. Part of the variability was clearly due to different laboratories using different methods for the same food, for instance acid hydrolyses versus solvent extraction. However, laboratories using ostensibly similar methods still reported widely diverging results.

— For available carbohydrates the $CV_{between}$ (excluding egg) ranged from 9% for biscuits to 27% for beans. Individual results for carbohydrate content of whole wheat meal ranged from 36 to 82 g/100 g dry weigh. Variability was somewhat reduced if differences in mode of expression (as g of polymeric starch versus as g of equivalent monosaccharides) were eliminated; the $CV_{between}$ now ranged from 7 to 23%. Effects of specific methods could not be identified because too many different methods were used.

— The $CV_{between}$ for total dietary fibre ranged from 23% for french beans to 84% for biscuits. A major part of this variability was due to the use of methods of different principle.

— Results for ash were reasonably consistent, with a $CV_{between}$ ranging from 3.3% for milk to 6.7% for egg.

— It is concluded that leading laboratories in different countries may produce widely different values for proximate constituents (macronutrients) in common foods. There is a need for better standardization of methods. As an initial step, reference materials of certified nutrient concentration should be produced and be made widely available.

TOWARDS A MERGED EUROPEAN FOOD COMPOSITION DATABASE

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Introduction

Few people have known how many and which compositional information on foods is available in Europe. Yet the thirst for information on foods increases as diet becomes implicated in greater and greater roles in cancer, heart disease and the instigation and promotion of other chronic diseases which account for the majority of premature mortality in Europe.

To enhance the availability of information, facilitate its use and promote a responsible application, a study is being conducted on merging nutrient (and non-nutrient) databases. This is a progress report of the advances and obstacles noted within the first year.

Merging databases — the technical issues

Simple entry onto a single host computer of data from various countries, once permission was received, presented some problems. Receiving permission also presented problems (see legal issues).

The first problem was recognized as lists were received from groups unable to prepare magnetic tapes. Some of the characters on these lists were not available on the keyboards used. Some were incompatible with specific printers. Others were just as technically difficult to enter as Chinese might be, because the sequence of consonants was so unfamiliar.

Floppy discs were also sent upon occasion with the hope that they might be readable. We discovered however that due to the formatting, density and operating system, floppy files created on a Macro-Micro could not be interpreted by our Apples, Commodores, Siemens or IBM PCs. We returned to entering the original lists manually.

Data tapes were thought to be the most desirable from for an exchange — relatively standardized and providing previously entered, edited information and text. This was often not as simple as hoped. The tapes labelled with more than eight characters from the United Kingdom could not be read by our IBM. Two other sets of data tapes became unreadable (also to their producer) during their transit, Unusual systems for marking beginnings and ends, unstandardized units of measure for a single nutrient within a data tape and lack of documentation made easy and efficient reading difficult. The ubiquitous poor documentation was a real hindrance. Neither position of parameters nor units were generally given. In one case the resignation of the only programmer caused problems for the group concerned and for us.

The most exciting and satisfying technical discovery was that EARN (the European Academic Research Network, 1985) could be used for transfer of large data files. After two trials at reading a Netherlands UCV tape (Kommissie, 1985), the work groups attempted to send the information directly — and the author upon logging in discovered instead of the normal remark that a message of 15 records was awaiting receipt and acknowledgement, a message stating that 30 000 records from a user from the Netherlands was found.

It was a complete, perfect file of Dutch and English names and nutrient values with source codes (we were ecstatic!).

Merging databases — the legal issues

Some countries offer their edited data as a free public service; other table producers are attempting to limit use (and access) by charging fees and even requesting licencing agreements from the user.

Concern was expressed about potential loss of revenues from local sales of tables if national food tables are available via an international merged online database. This, in certain countries, created a reluctance to voluntarily contribute data. Although by the Berne Convention (1886), scientific information is neither copyrightable nor patentable, at least one country is attempting to pass legislation to limit third party use. All the contributions of data for this merged database project were made available under the condition that this was only in the interest of a feasibility study, and was not to be distributed further.

Table 1. *Vitamin Units.*

	Vitamin A	Retinol	Retinol-equiv.	Carotene	total Carotinoids	active carotene provit. A	β-carotene	Vitamin D	Vitamin E	α-tocopherol	α-tocopherol equiv.	Vitamin K
Austria	Foreign tables in use											
Belgium	Er+											
Denmark		ug	ug				ug	ug		mg	mg	kl
FRG	mg			mg	mg			ug	mg			
Finl. Varo												
Turp.			ug									
Koiv.												
France: Ostr.		mg						mg	mg			
Randoin	mg					mg		mg	mg			
Renaud	mg					mg		mg	mg			
GDR		mg					mg	mg	mg			
Greece												
Ireland	Foreign tables in use											
Italy: Carn.			ug									
Fidanza		ug	ug	ug								
Norway	IU											
Poland		ug	ug	ug								
Portugal	IU			ug								
Spain			ug					ug				
Sweden:												
1. Skolupplage		mg	mg			mg		ug	mg			
2. Large tab.	mg/	mg/kg	Kg		mg/	Kg	ug/	mg/kg	mg/kg	Kg		
The Netherl.		mg										
UK				ug				ug	mg			

+1 ER = 1 ug Retinol = 6 ug β-Carotene

Merging databases — units, mode of expression and formats

Food tables (and databases) differ tremendously in their formats — some are books, others multiple volumes; some organized towards presentation of all nutrient information available for a single basic food, others are constructed around presenting the content of single nutrients for all source foods. The presentation formats are in some cases lists, in others matrices some with empty space for unmeasured values, others signalize missing values and some just drop any presentation of a mention of the nutrient in the case that no value is available, so that distinguishing between missing and zero is difficult.

In those tables which are organized in a tabular form, the sequence of components differ, as seen in diagram 1, and contributes to the possible errors in use. Also units of measure and expression differ — vitamin A µg in some, mmol in others, expression either as retinol equivalents, β-carotene or total carotenes. (The number of significant digits reported upon also range from two to four). An example of the presence of values and differences in expression for vitamins for European tables is shown in Table 1.

Diagram 1. *Examples of different food table formats.*

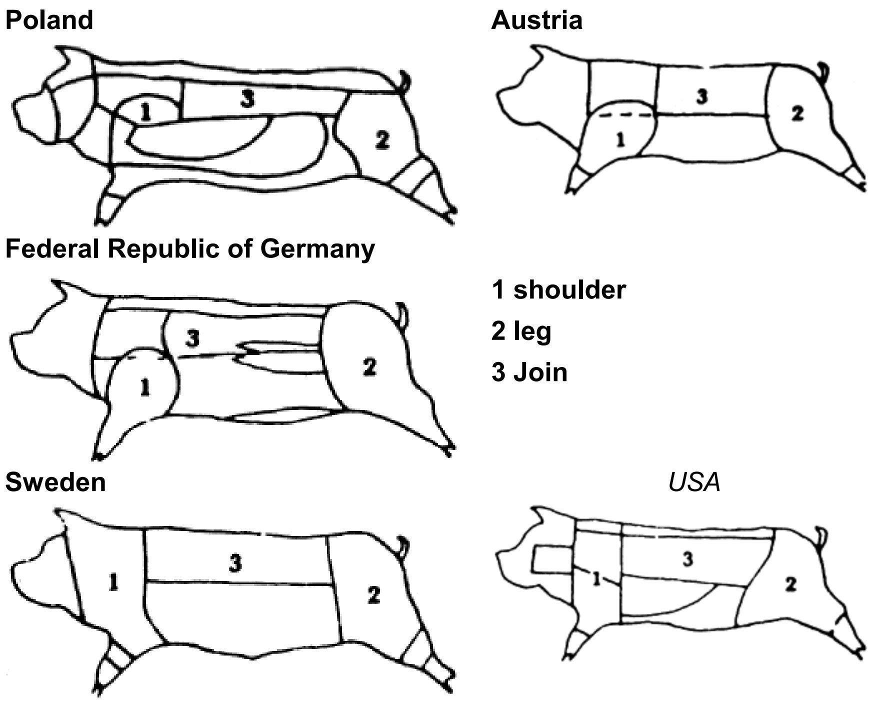
TABLE	DIRECTION OF ENTRIES	COMPONENTS							
FRC	↓	Energy		Water	Protein	Fat	Carbohydrates	Minerals total	. . . .
CDR	→	Code	Name	Energy	Water	Protein	Purin	Fat	. . . .
GREECE	→	Weight	Energy	Protein	Fat	Carbohydrates	Cholesterol		
ITALY	→	Code	Edible part	Water	Protein	Fat	Carbohydrates	Energy	. . . .
NETHERLANDS	→	Energy	Protein	Plant Protein	Animal Protein	Fat	Saturated Fat	Monounsaturated Fat	. . . .
NORWAY	→	Edible Protein	Water	Energy	Protein	Fat	Carbohydrates	Minerals	. . . .
UNITED KINGDOM	→	Description	No. of samples	Water	Sugar	Starch Dextrose	Fibres	Total Nitrogen	. . . .

Translational and terminology issues

Nothing new to persons professionally involved in translations, but a revelation to us was the finding that two similar terms have areas in which their meanings overlap, areas in which they are distinctly different (Iljon, 1977) and that agreement on development of a multilingual thesaurus is an expensive, painful process. It is not unlikely that the area of foods presented special problems because of common widespread use of the same terms (for different products) whole grain breads being an example. German and British whole grain breads are as different as night and day — whereas Norwegian whole grains are unleavened and sweet.

Scientific names can be applied to primary foods, but it has been reported that their misuse too is widespread and gross. Polacci reports non correspondence between local names, English and Latin names and both multiple Latin names for English names (W. Polacci: Review on 'Standardized food terminology' presented at the Eurofoods — Infoods Terminology meeting May 19–22, 1985, Heidelberg). An example drawn from the latter is ‘catfish’ which can be Bagrus bayad, Clarias lazera, Clupisoma garua, Eutropiichthys vacha, Heteropneustses fossilis, Mystus corsula, Mystus gulio, Mystus vittatus, Silonia silonia, Silurus triostegus, Syndontis spp., and Wallagu attu (different genus and families).

Diagram 2. *Pork meat charts.*



Even after clarification about the actual genus and species is achieved, agreement on the portion analysed (edible part) is needed. The different systems for cutting and labelling carcass sections presented problems due to considerable overlap (see Diagram 2).

During coding discussions, another issue of edible portion arose. The French delegate, in a workgroup with three Germans informed his colleagues of the unacceptability of eating Camembert cheese in its entirety — crust and all (as is generally done in the FRG). Thus the beliefs in edible portions differ, and the nutrient values which are based on the French food tables, do not include the outer portion (certainly rich in B vitamins) which is regularly consumed in other countries.

Processing and preparation methods are from terminology here, a difficult area. Particularly in this field, words have overlapping meanings in different cultures. The example of “braten” is a good one, a word which translated means without fat in one language and with fat in another.

In the course of this study a database was constructed including the native name and English translations (where possible) for all foods included in 15 published tables. To simplify cross referencing, Eurocode 2 numbers were assigned. The translations were in many cases newly made and provided for largely by Eurofood collaborators in the various countries. Entry of the native names was hindered by the need of special keyboards and character recognition for special non-English characters such as Ç, Å, Æ, t, ε, Ô. The tables from which translations exist can be seen in Table 2.

Table 2. *English translations from the introductions and foods in major European food tables.*

Foods	Introduction		
*	*	DENMARK	Moller
*	*	FED. REP. GERMANY	Souci/Fachmann/Kraut
	*	FINLAND	Koivistoinen
	*		Turpeinen
*	*		Varo
*	*	FRANCE	Ostrowski/Josse
	*		Randoin et al.
*	*		Renaud et al.
*	*	GERMAN DEN. REP.	Haenel
*	*	GREECE	Trichopoulou
*	*	ITALY	Carnovale/Miuccio
			Fidanza/Versiglione
*	*	NORWAY	The National Nutrition Council
*	*	POLAND	Piekarska/Los-Kuczera
*	*	PORTUGAL	Gonsalves Ferreira/da Silva Graca
*	*	SPAIN	Arias/Moreiras-Varela/Extremera
*	*	SWEDEN	Statens Livsmedelsverk
*		THE NETHERLANDS	UCV-Kommissie
*	*	UNITED KINGDOM	Paul/Southgate

A collection of translations of food table introductory materials into English has also begun. Those currently available are also shown in Table 2.

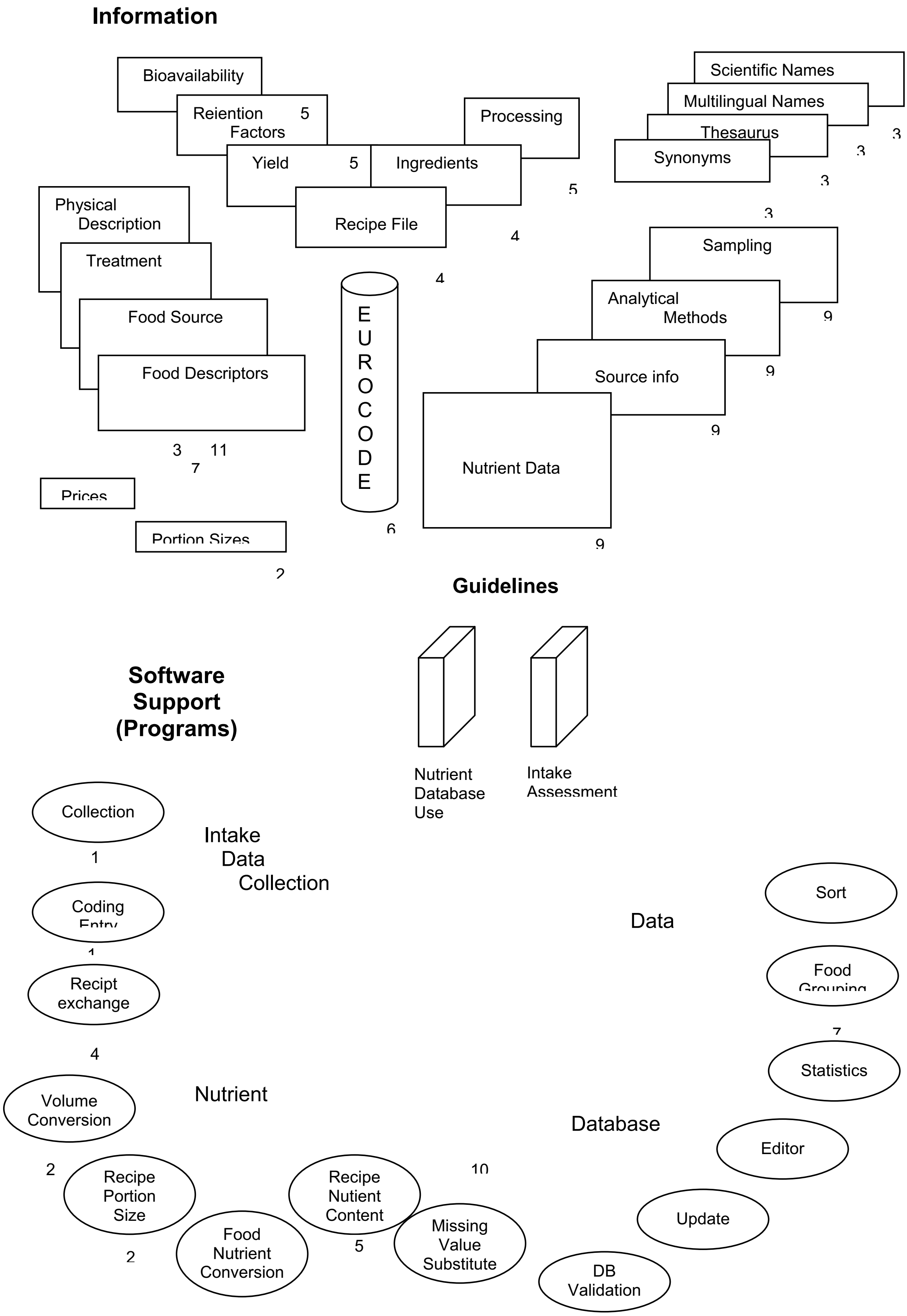
In the field of terminology and nutrient content mixed foods do present the greatest problem. It is absolutely essential to have some type of “recipe” or proportions of ingredients stored for any food codable which contains more than one primary foodstuff. Without recipes conversion to elemental foods for calculation of intakes (of eggs for example) can not be achieved. Recipes are also necessary for comparing foods. And they are desirable in any databases since they are often eaten, and the demand of a complete recipe process for each occasion of mixed food consumption is, in a large study, practically infeasible.

A complete database

From these thoughts, the concept of a total database, as outlined in diagram 3 was developed, incorporating many useful or necessary datafiles for different users.

Diagram 3 organizes the information on foods needed for different tasks into the following four groups.

Diagram 3. *Components of a complete food — nutrient database.*



Nutrient and non-nutrient composition values of food
These details include analytical method, sampling, source and type of information about the origin of these values.

Language files
These files provide the ability to reference foods on their scientific names, native names, English (and potentially any number of other European languages) and their descriptors.

Recipe files
In addition to consumption levels of primary products, information is desired by various groups on foods as consumed. Because issues of bioavailability, effects of processing interest and in the reasons for selection of specific food products, it is no longer satisfactory to convert intake information into 'raw ingredients'. Intake information should be stored as collected (and consumed), but potentially convertible into ingredients (e.g. when a pizza is consumed, it should be reducible to flour, oil, tomatoes, cheese intakes but stored in a single code), and for these files on standard, typical or averaged recipes for common mixed foods are needed. Recipe files are needed including proportion of each ingredient, processing and preparation steps involved for individual foods as well as yield and retention factors for food groups and individual nutrients.

Descriptors of foods
'Descriptors', including the characteristics and properties of foods and the preparation and preservation methods employed, are needed for identification of foods, their edible parts and to determine similarity of items.

All of these are components seen as structured around a common food code, to be used for cross referencing. Of course, files alone provide little information, they need to be accessed in a variety of ways, and a number of common applications are reflected in the list of software components which frame the bottom of diagram 3. They too are organized by function, intake data collection, compositional editing, updating, validation, calculation, and statistical analysis programmes. In a total system, guidelines and footnotes for use should be included.

The successful feasibility attempt in merging a few European food composition databases has shown that, despite all the interesting obstacles and surprises, a common system is feasible. Printouts from this system have graphically illustrated some of the uses which could be made of it (M. Wittler and L. Arab: Eurocode, 1985 — separate report in this monograph), and the project itself has stimulated new ideas and a design concept for a database on foods which would serve nutritionists, food technologists, epidemiologists, physicians, and dieticians.

The progress and promise of what this source could offer has led to a recommendation by an expert committee of the European Community Umbrella programme to begin supporting a similar venture. They advised that 'Research in this area, and indeed the whole of the European food safety and wholesomeness evaluation would benefit greatly from being underpinned by a coordinated European Data Base capable of cataloguing all the individual food products on the market in Europe and the available data on their composition and method of manufacture and processing'.

Conclusion

A feasibility trial merger of European food composition tables revealed that the technical obstacles, however tedious, are not difficult. The major hindrances are language and terminology. Proposals for resolving these are made, within the framework of a multifaceted food-component database structure. They include proposals for a standardized food coding and descriptor system. Such a system would facilitate enhanced use of foreign data, and should be designed to protect against inappropriate use of data for nutrient values of foods or products from remote dissimilar sources. A danger which already exists and is worsened by the language barriers currently confronting most conscientious ‘foreign users’.

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EUROFOODS: WORKING TOWARDS IMPROVEMENT AND DISSEMINATION OF FOOD COMPOSITION DATA IN EUROPE

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Preface

In February 1985, DG XIII B of the Commission of the European Communities awarded a contract to the University of Heidelberg on behalf of Eurofoods. The contract provided funds towards the study of the feasibility and methodology of developing an easily assessible data base of food consumption data derived from tables and data bases currently existing in various European countries.

The fourth task of the contract calls on the contractor to produce an estimate of the operational requirements of the development phase of the proposed Eurofoods merged data base of food composition data.

This paper has been prepared in order to fulfil this task of the contract under the supervision of the Co-ordinator (C.E.W.) and Deputy Co-ordinator (L.A.) of Eurofoods. Much of the work has been carried out by Miss Susanne Kuckuck in Wageningen while she was a holder of an International Agricultural Fellowship. We would like to thank the Netherlands Ministry of Agriculture and Fisheries for providing the fellowship. In addition we would like to thank the following people who assisted in carrying out this project: Mr. J. C. Rigg and Miss L. M. Koster of the Centre for Agricultural Publishing and Documentation (PUDOC) in Wageningen, Miss L.J.M. van der Heijden and Mrs G. J. C. van Oosten-van der Goes of the Department of Human Nutrition in Wageningen, Miss W. G. M. Boeijen of the Division for Nutrition and Food Research TNO in Zeist, Miss A. F. M. Kardinaal of the Department of Household Sciences in Wageningen, Miss M. M. van Essen of the State Institute for Quality Control of Agricultural Products (RIKILT) in Wageningen, and Dr R. Fritz and Mr Paul of the German Institute for Medical Documentation and Information (DIMDI) in Cologne.

1. Introduction

The contract obtained from the Commission of the European Communties calls for the production of an estimate of the operational requirements of the development phase of the proposed Eurofoods merged data base of food composition data.

This paper addresses the specific problems set down under the fourth task of the contract. These are to prepare: (1) a functional description of the services to be provided; (2) a description of the development work to be carried out and the organizations assuming responsibility for each phase of this work; (3) an estimate of the development costs of the services to be provided, and (4) an estimate of the running costs of the services to be provided.

In addition, questions of copyright and of agreements between Eurofoods and those providing data on food composition are discussed.

2. Functional description of proposed Eurofoods merged data base of food composition data and related products and services (Task 4.1)

2.1 Introduction

A pre-requisite for considering the services to be provided is knowledge of potentialusers of such services and their needs. Potential users encompass a wide range of institutions and individuals. The institutions include those of government, non-government organizations and companies which are involved in policy making; regulation; research; education and providing information at the group and individual level; and also food product development, production, preparation, quality control, distribution and consumption. Thus the individuals concerned have a wide range of interests and their training and knowledge are disparate. The needs of users are also varied and their needs as now perceived by them may be quite different to the actual use made of the services when such services become available. On the one hand, they may not be aware of the services available or be in a position for financial or other reasons to make use of such services.

In order to evaluate the number and nature of users and their self-perceived, potential and likely needs, a market survey is being carried out as part of Task 1 of this contract. The type of data required by different users will vary and could be provided in a number of forms: on-line access; in the form of magnetic tapes, etc. (off-line); and as books, etc. (hard copy). In addition to providing data in these various forms (see sections 2.2 to 2.4), users of products of a Eurofoods merged data base of food composition data would also require other products and services such as specialized computer programs, access to literature related to food composition data and a variety of aids. These products and services are discussed in sections 2.5 to 2.7.

2.2. On-line use

On-line use allows access in dialog to a data base through a terminal. Thus the user has rapid access to information which can be regularly updated. On-line access would attract a wide range of users varying from those requiring continuous access to up-to-date information to occasional users requiring rapid access to information in order to answer a specific question. The service provided should allow on-line use either with or without downloading. If data are downloaded, it should be possible for the user either to make use of his own software or that provided by the data base host (perhaps from the data base constructor). In addition to providing software, the data base host or constructor will need to develop manuals and to conduct training sessions to explain the service to be provided and how it can be used.

On-line access does have the disadvantage that it is expensive to develop and maintain. In fact it may prove difficult to cover costs, at least in the short term, without subsidy from a national government or the Commission of the European Communities. Subsidies may be forthcoming as the provision of up-to-date information on food composition may be seen as being in the national interest in monitoring and improving the health of the population. In addition, large numbers of occasional users may supply sufficient revenue to subsidize a service regarded as essential by regular users such as policy makers and research workers in agricultural and biomedical research.

2.3. Off-line use

Off-line use is use of electronic data without direct physical connection to a remote host. Thus information is provided in the form of a magnetic tape for main-frame computers or floppy disks (flexible diskette) which is the form most suitable for microcomputers.

Off-line provision of data has a number of advantages. Both the establishment and running costs are lower than for providing such data on-line, although data are not immediately available from the data source as they would be on-line. When compared to hard copy, in the form of a book for example, data can be made more immediately available as many of the procedures involved in producing a book are eliminated. For those people requiring data in machine-readable form, to carry out calculation of the nutrient content of foods for example, the laborious task of entering data via keyboard is eliminated. With the growth of the use of computers, particularly microcomputers, with their increasing versatility at decreasing cost, it is expected that the market for off-line use will increase more rapidly than use of data on-line or in the form of hard copy. This growing market will not only be in the traditional market of research nutritionists and dietitians, but also industrial users and the health-concious private individual. However, for many people and for many purposes, data as hard copy — such as in the form of a book — will remain the most attractive proposition.

It should be possible for users to purchase the amount of data they require. Thus some users may wish to purchase the entire data bank on a magnetic tape or series of tapes while others would require only selected data on a floppy disk because this would be cheaper and easier to handle on a microcomputer. The provision of selected or specialized data is discussed under section 2.4 (Provision of hard copy).

As for on-line use, provision should be made for data offered off-line to be used with or without user programs from the supplier.

2.4. Provision of hard copy

Another way of providing data for the Eurofoods data base would be in the form of hard copy which includes various forms of printed matter varying in size from large bound books to single sheets with specific information. In contrast to the present national food composition tables where the data applicable to each country is included in each national table, data could be arranged to bring together all the available data on particular products, product group or nutrient. Perhaps, data for each product group could be issued sequentially in separate volumes over a period of say five years, after which preparation of a second edition of the tables could commence.

Data could also be provided in the form of subsidiary publications for specific interest groups. One example of a special interest group which has already been considered by Eurofoods are tourists and other visitors to the various countries of Europe. Attention could be directed towards the requirements of particular sub-groups such as: (1) individual needing to choose foods in order to adhere to a diet for medical reasons, e.g. people with diabetes, hypertension or coronary heart disease; (2) individuals needing to avoid strictly certain foods for medical reasons such as people with food allergy to egg protein or gluten and those with congenital or acquired deficiencies (e.g., lactase deficiency); (3) individuals wishing to avoid strictly certain foods because of religion (e.g., Muslims, Jews and Hindus) or because of personal preference (e.g., vegetarians).

Another example of a special interest group would be those interested in products in which there is a large international trade. Information could be supplied on the nutrients of products usually imported from another country. Much of the data suitable for presentation as hard copy could also be provided in an electronic form, that is off-line.

2.5. Computer programs

A range of programs for facilitating the use of products of Eurofoods merged data base of food composition data will need to be developed and made available either by Eurofoods or by other suppliers preferably under licence to Eurofoods. Such programs would include those types which have been developed for use with national nutrient data bases. Examples of such programs include those for calculating the nutrient composition of complex dishes from the proportion of the various ingredients, for calculating the energy value from the proportion of macronutrients, for calculating the nutrient losses and gains during the preparation of foods and for calculating the cost of diets. Other programs would need to be developed for selecting appropriate data from the merged data base or data based derived from it, and for converting data in the format of each nutrient data bank to a common exchange format and *vice versa.*

2.6. Access to literature

Many users of the products of the Eurofoods merged data base of food composition data will want more information than just the name of the food and the content of a specific nutrient. Although it will be possible to include some additional data in the data base, the data provided will often fall short of that required for a specific purpose. Thus, users will need regular access to the scientific paper or report in which the data were originally documented. Mechanisms will have to be developed to satisfy these needs.

2.7. User aids

It will be necessary to develop manuals to enable users to use the various products offered by Eurofoods including on and off-line access to the merged data base, hardcopy versions of the data base and the computer programs made available by Eurofoods or suitable for use with Eurofoods products. It may also be necessary to develop or adapt an existing multilingual thesaurus to enable the name of a food used in one country to be related to that used in another country. Much work has been done in this area during the development of the Eurocode which was carried out under the second task of the contract from the Commission of the European Communities.

2.8. Special services

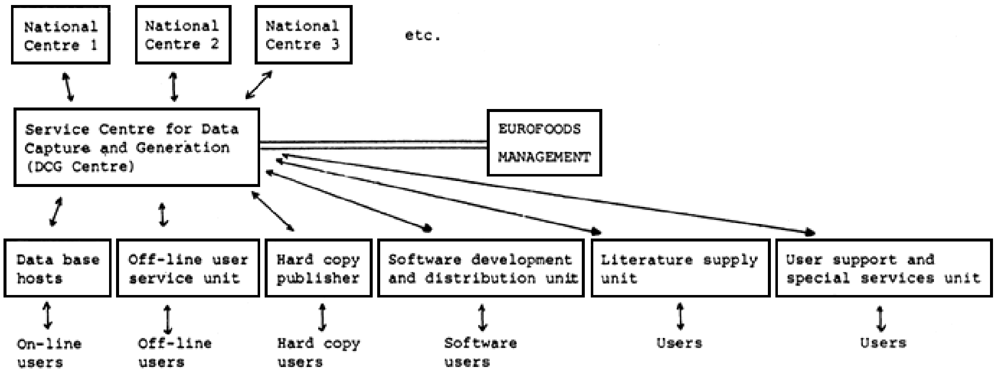
Although a range of special services could be developed, two need to be considered in particular. The first, and perhaps most important type of service, is the provision of training to enable users to gain the maximum benefit of the products and services available. Development of such training programs would be closely related to the development of manuals referred to in Section 2.7 above. The second type of service would be the provision of search and data handling/calculation facilities for those people who do not have computer facilities available which can access the merged data base system on-line or the magnetic tapes/floppy disks to enable them to access the various Eurofoods products off-line. This service could be provided either by Eurofoods directly or by others within a licence agreement with Eurofoods.

3. Description of the development work to be carried out and the organizations assuming responsibility for each phase (Task 4.2)

3.1. Introduction

It will be necessary for Eurofoods to establish a suitable structure to enable development work to be continued and products and services to be provided. The structure proposed is presented in Fig. 1. At the present stage, none of the components of the system required exist in their entirety. Those constructing food composition tables and nutrient data bases in individual countries are in effect national centres, but they are not in a position for a variety of reasons to supply data to a service centre for data capture and generation. Agreements will have to be made with the national centres to obtain the data (see Section 7) and the necessary resources to enable the work to be done will have to be provided. At the present time, most national centres do not publish the sources of their data so additional work will be required to get this into a published form.

Fig. 1. *Proposed structure for the Eurofoods merged data base of food composition data*



3.2. Role of Eurofoods

It will be the responsibility of Eurofoods to develop agreements with the various components of the system and to ensure that the operation is of a high technical standard and financially sound. Funds for the system will be obtained from the sale of products or services. However, it is envisaged that, at least for the first five years, funds from various sources will be required before the system can become selfsupporting.

3.3. Service centre for data capture and generation (DCG centre)

It will be necessary to establish a service centre for data capture and generation (DCG) either as an entirely new enterprise or by contracting the work out to an existing organization. Such an approach is taken by the International Food Information Service which users the services of Satz-Rechen-Zentrum Hartmann and Heenemann KG in Berlin. The work for IFIS involves bibliographic and not factual data as is the case with the food composition data in the Eurofoods system. Management of the two types of data base systems is quite different.

There are two main components to the development work before the DCG centre can be operational. The first is the creation of a common exchange format which will enable the data from the national centres to be transferred to the DCG Centre. Preliminary work on the development of such a common exchange format has already been carried out by a sub-committee of the Eurofoods Computer Committee because of the interest in transferring data between those responsible for nutrient data banks in the individual countries of Europe.

Another possibility would be to use a system currently in use by a data base host. For example, the data base host DINDI (Deutsches Institut für Medizinische Dokumentation und Information) has developed a system known as GRIPS (General relation-based information processing system) which would be very suitable as a common exchange format. Adoption of such a system would save not only on thecost of the developing the system itself but also on the cost of developing a program to transfer data from the DCG Centre to a data base host using the system in question. Incidentally, it should be remembered that programs have to be written to transfer data in the format of a national centre to the common exchange format and also for transferring data from the common exchange format to that of a national centre. That is, two programs are required for each national centre. Naturally, such programs would also allow ready transfer of data between national centres.

The second component of the development work to be carried out before the DCG centre can become operational is the design and construction of the merged data base itself. Generally, there is less experience in the development of factual data bases such as the one envisaged than there is for bibliographic data bases. However, much experience has been obtained during the carrying out of Task 2 of the present contract and in a joint Eurofoods-Infoods research program. In December 1985, Dr Arab spent two weeks at the Massachusetts Institute of Technology working with Dr Klensin of Infoods on this problem. The design and construction of the data base can be divided into a number of separate stages:

* functional specification of the data base
* system development
* data base construction

The *functional specification* of the data base will establish the criteria used to define the data and will thus enable decisions to be made on how the data will be processed prior to storage, stored and how it can be used both on-line and off-line in form of tapes, floppy discs and as printed material (see Sections 3.4 to 3.6). *System development* involves the design of a data base and the software to be used with hardware chosen to produce a data bank. *Data base construction* involves the actual entry of data from the individual national data centres into the Eurofoods merged data base of food composition data and its validation and correction.

3.4. Data base host

It is envisaged that the initial development work will be carried out by one data base host and that a period of time (possibly one year) would be allowed to elapse before a second vendor would be offered the opportunity to host the data base on-line. The development work involved before an on-line service could be offered can be summarized as follows:

* analysis of input and output formats which would enable the type of system required to be determined;
* definition of the specifications for the design and structure of the data base in consultation with Eurofoods who would represent the interests of the data base suppliers (the national centres and the DCG Centre) and the users.
* establishment of a test data base and system lay out and provision of a test system;
* obtain acceptance of the system by Eurofoods;
* construct the initial data base system; and
* place the system on-line.

Experience gained as part of Task 2 of the present contract will be very useful during the development work to be carried out. In addition, most hosts also have formats which could be used for storing the data so it will not be necessary to develop the system from nothing.

3.5. Off-line user unit

The task of the off-line user unit will be to provide magnetic tapes and floppy discs containing, generally, only extracts of the data held in the DCG Centre (see Section 2.3). Development work will involve the creation of an initial range of products in formats suitable for a variety of users after carrying out a market study. Physically, the off-line user unit may be a part of the DCG Centre, but its task is quite separate as it must service the needs of those requiring data off-line. It will have to work in close cooperation with the software development and distribution unit because most users will require software to enable them to use the food composition data (see Sections 2.5 and 3.7).

3.6. Hard copy publication unit
The work of the hard copy publication unit will be analogous to that outlined for the off-line user unit. The range of products which could be provided are given in Section 2.6.

3.7. Software development and distribution unit
The software development and distribution unit will be responsible for the development of software appropriate for use with food composition data provided both on-line and off-line (see Section 2.5). Software will be written both in-house and under contract for sale by the unit. In addition, software will be written by third parties for use with Eurofoods data. Development work will involve the creation of an initial range of products after carrying out a market survey.

3.8. Literature supply unit
Arrangements will have to be made for making available to users literature such as articles containing original analytical data (see Section 2.6.). However, this task could almost certainly be carried out by existing organizations so the developmental work required is probably minimal.

3.9. User support and special services unit
As mentioned in Sections 2.7 and 2.8 it will be necessary to develop manuals and to conduct courses to enable users to gain maximum benefit from the products and services to be supplied by Eurofoods. As the acceptance of the products services of Eurofoods depends on the quality of user support and services, much development work will need to be carried out in this area.

4. Estimate of the development costs (Task 4.3).

4.1. Introduction
The major development costs for establishing the proposed Eurofoods merged data base of food composition data and related products and services involve establishing the service centre for data capture and generation (DCG Centre) and getting the system on-line. However, it is necessary to examine the costs of the individual steps in the whole system.

4.2. Data retrieval from national data centres
The major development cost as far as retrieval of data from the national data centres is concerned is probably the cost of writing a program to translate the data into the common exchange format. Naturally, if the data base is already in the common exchange format, no work is involved but generally this will not be the case. Usually, additional fields in the data base will have to be created for such information as references to the source of information, analytical method used, Eurocode etc. It is envisaged that the work would take up the time of one individual for one month for each country. For an initial system with ten countries this might represent 40 000 ECU. This money would probably have to be provided by Eurofoods although the work could be contracted out to the individual national data centres.

In addition to the above costs, there will be the cost of obtaining access to the data. As outlined in Section 6.9, it may well be that Eurofoods would not be in breach of copyright if data from national data bases of food composition were incorporated in the Eurofoods merged data base. However, in the interests of ‘fair use’, Eurofoods would have to come to some agreement with the national data centres. Payment by Eurofoods would depend on:

- ★ whether the national data centres would be entitled to royalties on their data when is provided to third parties;
- ★ whether Eurofoods is allowed under its statutes or constitution to make a profit;;
- ★ whether the third parties receiving the data are allowed to sell the data for profit, and
- ★ whether the national centres would be entitled to preferential rates in using Eurofoods products and services.

It would be possible for Eurofoods to obtain the tapes or the cost of an empty magnetic tape; at the cost to normal users who usually sign an agreement to say that they will not pass on the data to third parties; or at a higher tariff because of the intention to sell to third parties. A decision will have to be made on this matter. However, it is envisaged that changes levied will be included in the running costs rather than as part of the costs of development (see Section 5).

4.3. Establishment of the merged data bank at the Service Centre for Data Capture and Generation (DCG Centre)

The first cost item for development work in this category is for the creation of a common exchange format. As outlined in Section 3.3., this cost will be minimal if a system currently in use by a data base host is adopted. Otherwise it could cost 20 000 ECU. The second cost item for development work would be the cost of creating the merged data base itself. As discussed in Section 3.3, the cost of the design and construction of the merged data base can be divided into three (A, B and C) to which overhead costs have to be added.

A. Functional specification of data base	
Staff costs, 5 man-months	20 000 ECU
Travel	5000 ECU
Other costs	5000 ECU
	30 000 ECU
B. Systems development	
Staff costs, 2 man-months	8000 ECU
Depreciation on hardware	5000 ECU
Depreciation on software	10 000 ECU
Other costs	5000 ECU
	30 000 ECU
C. Data base construction	
Staff costs; 2 man-months	8000 ECU
Data processing	5000 ECU
Data collection, subscription and copyright	20 000 ECU
Depreciation of hardware	3000 ECU
Depreciation of software	3000 ECU
Other costs	5000 ECU
	44 000 ECU
	+10 000 ECU*
	112 000 ECU

* overhead costs

4.4. Establishment of an on-line system

The cost of the developmental work outlined in Section 3.4 is envisaged as 90 000 ECU of which about 70% are staff costs, 10% computer costs 5% travel, 10% overhead costs and 5% other.

4.5. Establishment of the system off-line

In the absence of a market survey, it is difficult to estimate the development costs of an off-line service. However, it will probably include the costs of one individual for a year (48 000 ECU), which with computer costs (10%), travel costs (5%), overhead costs (10%) and other (5%) will increase the cost to 68 000 ECU.

4.6. Provision of hard copy

The development cost of getting books ready for publication will be of the same order as for establishing the system off-line (68 000 ECU). In addition, there will be printing costs which could amount to 30 000 ECU in the first year. However, it is essential that the market be fully investigated before books are produced.

4.7. Software development

It is envisaged that the costs for the type of products mentioned in Section 3.7 will be of the same order as for the establishment of the system off-line. Thus 68 000 ECU should be reserved for this activity.

4.8. Supply of literature

As it is envisaged that this work will be carried out by existing organizations, a minimal 1000 ECU should be set aside for this activity.

4.9. User support and special services

As the success of the products and services to be supplied by Eurofoods depends on the acceptance and use by the community, 30% of the total development costs will be allocated to user support and special services. This represents 187 000 ECU.

4.10. Summary of development costs

Data retrieval from national data centers	40 000 ECU
Establishment of merged data bank (does not include cost of developing a common exchange format)	112 000 ECU
Establishment of on-line system	90 000 ECU
Establishment of off-line system	68 000 ECU
Provision of hard copy	98 000 ECU
Software development	68 000 ECU
Supply of literature	1000 ECU
User support and special services	187 000 ECU
TOTAL	624 000 ECU

5. Estimate of the running costs (Task 4.4)

5.1. Introduction

It has been very difficult to estimate running costs for all aspects of the work except for the operation of an on-line system where information from DIMDI was available. The costs of training, marketing and servicing user needs are included under each activity.

5.2 Data retrieval from national data centres (rough estimate)

Can depend on the agreements reached with the individual national data centres (see Sections 4.2 and 7), but could be of the order of 10 000 ECU per year.

5.3. Operation of the Service Centre for Data Capture and Generation (DCG Centre) (very rough estimate)

It is envisaged that annual running costs of the service centre for data capture will be as follows:

Staff costs, 12 man-months	48 000 ECU
Computer costs	10 000 ECU
General administration costs	10 000 ECU
Travel	5000 ECU
Other	5000 ECU
TOTAL	78 000 ECU

5.4. Operation of an on-line system (based on information supplied by DIMDI)

The running costs of an on-line system comprise the following components:

- ⋆ cost of storing data base in the computer at the data base host
- ⋆ cost of updating the data base
- ⋆ cost of training and marketing
- ⋆ cost of servicing other needs of users.

For a data base of the size envisaged, 10 000 PAM (primary access method) pages in the DIMDI Siemens system would be required to store the data itself, reference file, code book file and the food description and language file. The cost of storing this amount of data is DM 234 per month excluding tax which is equivalent to 1400 ECU per year.

The cost of updating will depend on the number of different times that someone would have to carry out the operation but it is not envisaged that will take more than 0.5 man-month per year (2000 ECU per year) plus the computer time which will cost approximately 6000 ECU per year.

Thus the costs of maintaining the data base system on line are as follows:

Storage of data base	1400 ECU
Updating data base	8000 ECU
Training, marketing, user needs etc.	4000 ECU
TOTAL	13 400 ECU

However, it would be hoped that within a number of years that the on-line system would be selfsupporting and would be able to contribute substantially to the costs of data retrieval from national data centres and the cost of running the Service Centre for Data Capture and Generation.

5.5. Operation of an off-line system (very rough estimate)
It is envisaged that the annual running costs of an off-line system will be as follows:

Staff costs, 6 man-months	24 000 ECU
Computer costs	4000 ECU
General administration costs	8000 ECU
Training, marketing, user needs etc.	16000 ECU
TOTAL	52 000 ECU

5.6. Provision of hard copy (very rough estimate)
It is envisaged that the annual costs for the provision of hard copy will be as follows:

Staff costs, 3 man-months	12 000 ECU
Consultant costs	24 000 ECU
Printing costs	30 000 ECU
General administration costs, including computer costs	8000 ECU
Training, marketing, user needs etc.	16 000 ECU
TOTAL	90 000 ECU

5.7. Provision of software (very rough estimate)
It is envisaged that the annual costs for the development, distribution and marketing of software products will be of the order of 50 000 ECU.

5.8. Supply of literature
As it is envisaged that this work will be carried out by existing organizations, a nominal 1000 ECU per year should be set aside for this activity.

5.9. Expected income
This will become apparent when results of the market survey become available.

6. Copyright
6.1. Introduction
There are a number of barriers to the free flow of scientific information (Baker, 1985). In earlier sections, a number of economic, technical, political, social and cultural issues have been addressed. In this section, the question of copyright will be considered while another aspect of intellectual property rights and legal mechanisms, namely contracts, will be discussed in Section 7.

In order to provide a background to consideration of copyright, a short summary of the principles of copyright, as outlined in the UNESCO (1981) publication *The ABC of copyright*, is given in Sections 6.2 to 6.7. The basis of copyright law in Europe is the Berne Convention of 1886 and its five revisions (Paris, 1896; Berlin, 1908) Rome, 1928; Brussels, 1948 and Paris, 1971). Protection under the Conventions is extended without formalities to works by nationals of any country on the sole condition that publication first takes place in a country which is a signatory to the Berne Conventions.

Most European countries are signatories to the Conventions although some have not been signatories to all of them. In addition, most European countries have ratified or acceded to the Universal Copyright Convention of 1952. The Universal Copyright Convention, which is not as rigorous as the Berne Conventions, is applicable in Europe only with respect to agreements with countries outside Europe in particular the United States (Anonymous, 1976).

6.2. Underlying principle of copyright

The underlying principle of copyright is that individual creators (artists, writers) are entitled to protection against unauthorized use of their work as well as a share in any earnings from its use by the public. The author is entitled to an exclusive, transmissible right in all forms of economic exploitation of his work, whatever their value and purpose.

Copyright protects original works of intellectual creation in the fields of art, music, science and literature. The works themselves are protected: that is, the form or manner of expression and not the author's ideas. Ideas, systems, principles and methods may not be copyrighted. There must be an expression of an idea in a material form such as a book, magazine, painting, musical composition, choreograph, film or phonograph record. Unauthorized copying of the work is tantamount to theft. An original work is defined as the product of one person's independent thought and labour.

Copyright laws make a clear distinction between the rights of the copyright owner and the rights of someone who owns a physical object such as book, record or painting. If an author sells his original work, this implies transfer of the copyright in it only if he has signed a contract stipulating such transfer. This implies that, once a copy has been lawfully made, the owner of the copy can dispose of the physical object as he sees fit but he cannot duplicate the copy without permission of the copyright owner.

The law gives to authors certain exclusive rights for a limited time in relation to so-called literary works. These rights enable the author to share in any earnings from use of his or her work. Because of the need to find a balance between the author's personal rights and the needs of society for knowledge and information, the exclusive rights of authors have sometimes been limited by law. In cases where the law expressly permits use of the work under compulsory or statutory licence, the owner cannot prohibit use of this work but the user must nevertheless pay for the use.

If a publisher wants to make changes in the work he considers reasonable to meet certain editorial standards, or if he wished to make an abridgement or include a short work in an anthology, he is obliged to obtain the consent of the author.

6.3. Economic rights of authors

All copyright laws reflect the guiding principle that the author is entitled to a reasonable share of the economic returns from public use to his work. Economic rights generally correspond to the different ways in which a work may be used. The author of a protected work has the exclusive right to authorize a variety of acts that fall into two broad categories: (a) the right to reproduce the work, and (b) the right to communicate the work to the public (basic economic rights).

The most fundamental right granted by copyright laws is the right of the author to authorize the making of copies of his work. Reproduction involves many separate rights deriving from a multiplicity of methods ranging from printing to engraving, lithography, photocopying and photography to making films and phonograms (rights of reproduction). Sometimes the right of reproduction includes the right to put a work into circulation or the right of distribution. Sometimes, these rights are protected jointly, sometimes separately. When making a contract for reproduction of his work, the author has the power to define the terms and conditions of distribution of copies. These contracts cover such questions as quantity, price and geographical area of authorized distribution.

An example of a modern law listing particular rights is that of the Federal Republic of Germany, which passed into law in summer 1985 (Thuss, 1985).

6.4. Protected works

Generally speaking, protected works are intellectual creations in the fields of literature, music, art and science.

Works may be communicated to the public in either written or oral form. Works must contain these elements: expression in a form and being original. Anglo-Saxon laws often require the additional criterion that works to be copyrighted be fixed in a tangible form. This is not a requirement in laws of the Roman legal tradition which speak only of forms of expression.

Originality in the context of copyright law means that the work must be original in the sense that it has not been copied from another work. It must also represent a considerable amount of creative authorship. Definition of the subject matter differs in the various national laws.

Copyright protection is also provided to a collection of works derived from pre-existing works. Such collections are protected as original works since their creation requires a process of recasting, transforming or adapting the pre-existing work, and the permission of the copyright owner of the original works is required in order to make derivative works. There are two types of derivative works that are generally given copyright protection: (a) translation, adaptations, arrangements and other transformations or works, and (b) collections or compilations such as anthologies.

The right to a derivative work does not prejudice the right to the works from which it is compiled. In general, therefore, agreement, not only of the author of the new work but also of the authors of the works used to create it, must be obtained in order to publish a derivative work.

Whereas translations are copyrighted because of the knowledge involved (two languages and subject matter), national laws generally stipulate that collections and compilations are protected only if they have involved intellectual creativity in the editing and arrangement. The copyright of a translator or adaptor does not prejudice the copyright of the author of the original work.

6.5 Limits to copyright protection

Once a work has been published, or otherwise communicated to the public, the exclusive rights of the copyright owner are subject to some limits. Copyright may not apply to some works. In all countries, there are works that have fallen into the public domain because the term of copyright protection has expired. In particular cases, under certain conditions spelled out in copyright laws, a copyrighted work may be used without the copyright owner's consent. The grant of copyright is a limited monopoly, not only in the scope of the rights granted, but also in terms of time. There are two general categories of works that are not protected for reasons of public interest: official acts (and in some cases government documents) and the news of the day.

Some limits or restrictions are also imposed on copyright protection in the sense that some uses of protectd works are permitted without the author's consent. Sometimes, in these cases, payment is required, sometimes not. These limits on copyright have been accepted out of a need to balance the public's interest in access to science and the arts with the rights of authors. Exceptions to the exclusive rights of authors find justification not in the contents of a work but in the intended purpose of the person who used the work without the author's consent. These exceptions or limits to copyright are found in laws of the Roman legal tradition. In laws of the Anglo-Saxon tradition, more or less the same criteria are adopted under a concept that has been called ‘fair use’ or ‘fair dealing’. It is a concept that defies precise definition, but which has been accepted and described by the courts.

Several questions are taken into account by the courts when considering cases of use under these exceptions. They include the amount and substantially of the portion used in relation to the entire work, the purpose and character of the use (whether commercial or non-profit), the nature of the copyrighted work and the effect of the use on the potential market or value of the copyrighted work.

These restrictions concern primarily works that the public should be allowed to use freely under certain conditions to further public policy objectives of mass communication, criticism or education. These exceptions apply to private and/or free communication; copies or reproduction strictlyreserved for private use: quotations: instructional use; archives and libraries; and permanent monuments of works situated in public buildings.

Under the system of compulsory licences, the copyright owner is obliged to grant authorizations for use of his work by third parties, but unusually retains the right to negotiate the terms of the use. When the parties fail to come to an agreement, the amount of the remuneration is fixed by some competent authority. In some states, this is done by civil courts and in others by agencies such as copyright tribunals.

The author's right of translation is also limited by some laws so that works may be more readily available in other languages. Translation and reproduction rights are authorized under compulsory licence by some laws.

Statutory licences, sometimes called ‘legal’ licences, are similar to compulsory licences in that a work may be used without the copyright owner's consent, subject only to payment of a fee, with the difference that the amount is prescribed by a competent authority. The legal licence applies to the right of mechanical reproduction under which royalties are fixed as a percentage of the retail selling price of the recordings. In some states, they are calculated on a numerical basis, a prescribed amount for each playing surface. Usually the royalties resulting from such users are paid to a body designated for the purpose and that body or society distributes them to the authors concerned in accordance with established rules.

6.6 Copyright ownership

Many states hold that only human beings or natural persons can be the original owners of literary or artistic works. A legal entity can only buy or otherwise acquire the copyright in a work since it lacks the capacity to create a work and therefore cannot figure as an author. This approach is most commonly found in states adhering to the Roman legal tradition.

The laws of certain states, on the other hand, recognize that copyright may belong, in the first instance, to a corporate body or legal entity in contrast to a natural person. This is true primarily in states of the Anglo-Saxon legal tradition. For example in some countries, a legal entity is deemed to be the author of a work produced by its employees in the course of their work. Among the legal entities that may own copyright under different laws are the state, governmental services or agencies, municipalities, academies, universities and institutes.

Two or more persons may collaborate in the creation of a work. They may work in such a way that their contributions are merged and cannot be distinguished within the finished work. Works in which several individuals have collaborated on the component parts linked together into an inseparable unit or whole have been called ‘joint works’ or ‘collaborations’. In such cases, the coauthors are usually considered as co-owners. In general, this means that a person who wants to utilize the work must first obtain the agreement of all the authors.

In spite of the fact the the contributions to collective works (equivalent to composite work, that is a new work for the preparation of which a pre-existing work is incorported) are separate and discernible, they are usually undertaken on the initiative of one individual or legal entity and put together by someone who plans, arranges, co-ordinates, prepares and publishes the collection. It is generally recognized that, without prejudice to the copyrights in the individual works so assembled, there is a separate copyright in the ensemble. Many laws deal with this point, designating the editor or director of the work as the owner of copyright in the collected work as a whole. Subject to stipulations in the contract, copyright in the individual contributions may, however, belong to the respective creators. In the case where pre-existing work is incorporated with new work, both creators will have copyright in their respective works. Utilization of such works requires the authorization of both of them.

The Berne Convention states that copyright protection may not be subject to any formality. The protection of author's rights should flow automatically from the act of creation and should not be dependent on compliance with any procedures.

The copyright laws of most states require that some kind of notice be affixed to all copies of a work to inform the public that copyright protection is claimed in the work. The international accepted copyright notice, provided for in the Universal Copyright Convetion (1952), is composed of three elements: the symbol ©, the name of the copyright holder and the year of the first publication of the work.

6.7. International copyright

States that have ratified, or acceded to, either the Berne Convention or the Universal Copyright Convention (UCC) or both (most of the European countries) have an obligation to see that their domestic laws are in conformity with the convention binding them. It is possible, however, for national legislation to comply with convention principles in different ways and to work out voluntary or legislative solutions to such pressing contemporary questions as limits for photocopying.

Common to both conventions is the fundamental principle of national treatment. According to this rule, works originating in a contracting state are protected in every other contracting state in the same manner as states protect works originating within their own territory. Stated in another way, works by a foreign author enjoy the same protection as the works of national authors.

Translation requires the authorization of the copyright holder of the original work. However, under certain conditions and after complying with certain formalities and the payment of royalties, authorization may be waived. The government of the country that wishes to publish the translation can grant a licence replacing authorization of the copyright owner when seven years (UCC) or ten years (Berne Convention) have passed from the date of the first publication in the original language if no translation has been published in the national language of the requesting country.

6.8. The legal basis of copyright with respect to Eurofoods

Copyright protection in a particular country basically depends on the national laws of the country concerned, although these laws are regulated to a large extent by the Berne Conventions and the Universal Copyright Convention which have been ratified or acceded to by most European countries. Thus the operations of Eurofoods will depend on where Eurofoods is regarded as being resident. It is expected that Eurofoods will be established as a legal entity in The Netherlands early in 1986 although it may well be that the greatest part of the work of Eurofoods, for example the establishment of the merged data base of food composition data, will take place in another country such as the Federal Republic of Germany. However, this should not present any difficulties because protection of foreign works is provided for under the Berne Conventions and the Universal Copyright Convention.

The establishment of Eurofoods as a legal entity has consequences as far as copyright law is concerned. Under the Anglo-Saxon legal tradition, a copyright owner can only be a legal entity, not a person, while under the Roman legal tradition, only the person involved with collection, organizing, arranging and editing can obtain copyright for the new work. Under Dutch, German and English law, the vendor of the products of the Eurofoods merged data base of food composition data must have corporate legal existence to provide adequate protection of copyright interests. Although it would be possible to continue to work in the name of one or more of the partner academic or research institutions or to work with an existing information service, it is envisaged that Eurofoods will be established as a limited company along the lines of the International Food Information Service. A limited company offers a number of advantages over legal entities such as a foundation or an association.

6.9. The role of copyright in the operation of Eurofoods

As far as Eurofoods is concerned, the question of copyright arises at two levels: obtaining data from other sources and the provision of data by Eurofoods to users.

It is important for Eurofoods to have ready access to data, particularly those from national food composition tables and nutrient data banks. Thus it will be necessary to reach agreement with such data producers and compilers (see Section 7). However, it is by no means clear that it will be necessary for Eurofoods to obtain copyright permission to use such data. Thus any agreement made with data suppliers should state that Eurofoods does not admit that the data obtained is protected by copyright. Agreement would be necessary from the point of view of 'fair use' in data handling although not necessarily from the point of view of copyright. Eurofoods will need to be able to obtain regularly updated data usually on magnetic tape from the national compilers of food composition data. There is doubt about the ability of the copyright owners of national food composition tables to protect their investment in constructing tables under copyright law because data *per se* cannot be the subject of copyright although the form in which it is presented can be. Thus if it can be established that the *products* arising from the merged data bank of food composition are collective or composite works (Section 6.6), the question of copyright may not apply. Selection and arrangement of the contents in the new works must meet the criterion of originality. Copyright in the individual contributions may, however, belong to the original creators. Thus it would appear that some Eurofoods products such as a food composition table for tourists would not require copyright permission from the suppliers of the data before it can be sold while other products such as the merged data base as a whole may well require such permission. Even sale of the merged data base would not infringe copyright law if it could be established that it had a format which could be regarded as original.

It will be important for Eurofoods to obtain copyright protection for its products. As stated above data *per se* cannot be protected by copyright law, although protection by copyright law extends to the form in which the data is presented. Agreements with the users of Eurofoods products will have to made in order to ensure that the source of income for Eurofoods is protected (see Section 7). It may well be that some of the income derived from the sale of Eurofoods products will be passed onto the suppliers of the data to Eurofoods. However, as mentioned above, such an arrangement would not necessarily imply that the suppliers of the data were entitled to that income under copyright law. In general, most products will be sold for use only by the customer. Thus contracts should contain a definition of 'customer's own use'. In addition to protecting the copyright of Eurofoods products containing food composition data, it will be necessary to ensure copyright protection for other products such as user manuals and computer software. As the problem of copyright protection of computer software is somewhat complicated, it is dealt with separately in Section 6.10.

6.10. Copyright protection of computer software

At present copyright protection for software seems to be a great problem in most countries. As it is seldom included in laws as a special aspect, the provisions of existing laws have to be interpreted with respect to software.

In the USA, computer software has been covered by the copyright law since 1980. Whereas software is not patentable, operating systems can be copyrighted, even a program embedded in ROM. Codes, object and source codes, may also be copyrighted. In 1977 the National Commission on New Technological Uses of Copyrighted Works prepared recommendations to be submitted to the U.S. Congress on copyright changes with respect to computer-readable works. If they had been accepted, both computer-readable works. If they had been accepted, both computer-readable data bases and computer programs in source language could be copyrighted in any tangible medium of expression. However, complete disclosure to the Copyright office of the contents of the data base or the computer program, accompanied by a usage manual, would be required.

A novel way of preventing unauthorized duplication of software is being pioneered in the USA. Called 'shrink-wrap licencing' a software licence is established as soon as the user/buyer breaks open the package in which the software is contained. There are two provisos: inside the package there has to be contract affirming the legality of the agreement; and there has to be a clearly visible legend stating the conditions of acceptance before the package is opened.

In Great Britain the government recently announced that it will support a private Member's Bill which aims at extending copyright protection to computer programs. It is hoped that the Bill will clarify the current doubt surrounding the application of the 1956 Copyright Act to computer programs. It will extend to computer programs the new offences, increased penalties, and new police powers that were introduced in 1982 and 1983 to reduce video piracy in the UK.

As protection of software programs lies in the sphere of responsibility of the customer's national copyright law these laws as well as new developments, recommendations, judgements of the court (leading cases) must be carefully checked before selling programs in the different countries.

It may well be that the new copyright law in the Federal Republic of Germany may contain reference to computer aspects but this has not been followed up.

7. Agreements with those providing food composition data

7.1. Introduction

The success of the Eurofoods data base of food composition data depends to a very large degree on ready access to the individual food composition data bases in the various European countries. As discussed in Section 6.8, there may in fact be no infringement of copyright in using data from the national data bases but in the interests of fair use, Eurofoods should reach agreement with those responsible for such data bases. Agreement has to be reached on a number of specific issues:

- conditions under which Eurofoods can provide data to third parties;
- remuneration for providing access to data from a national data base;
- remuneration for supplying data from a national data base in the standard exchange format;
- the timing of supply of new data to Eurofoods;
- the role of national data base centres in marketing Eurofoods products and services.

7.2. Conditions under which Eurofoods can provide data to third parties

It is in the interest of the project that Eurofoods is as free as possible to provide data to third parties. It would seem that the only restriction would be that they should not compete directly with the national data base centre without adequate compensation to the national data base centre.

7.3. Remuneration for providing access to data from a national data base

The question of pricing has been discussed earlier (Section 4.2). It may well be that Eurofoods will not have to pay cash for obtaining access to such data but may be able to give the national data base centres preferential treatment in access to the merged data base. Such preferential treatment could be in terms of price or in allowing them to use the merged data base before it becomes available to the general public. This would allow the national data base centres to check their data against data in other European data bases before their own data bases were made available. National data base centres may also be able to use software specially developed by Eurofoods (see Section 2.5).

7.4. Remuneration for supplying data from a national data base in the standard exchange format

Converting a data base from the format of a national data base to that of the standard exchange format will require work. It may well be that Eurofoods will have to make some contribution towards the cost of this work. However, such payment could also be in the form of preferential treatment as outlined in Section 7.3. It should also be remembered that once the data are in the standard exchange format they can be transferred to other national data base centres participating in the Eurofoods system.

7.5. Timing of supply of new data to Eurofoods

It would be in the interests of the merged data base of food composition data if data could be supplied at fixed dates. This would allow the merged data base to be updated in a co-ordinated fashion. In choosing the time when data should be available for updating and the frequency of updating, a number of matters have to be considered. On the one hand, users want to have access to recently published data as far as possible especially in the case of on-line users. If the interval between updating is too long, for example larger than six months, the value of the on-line service is diminished as the data would be available more cheaply off-line. On the other hand, many users require that the data base remains stable for a sufficient length of time so that results obtained with the data base are comparable. It may well be that some users will need access to data which is no longer current. Possibily, an update interval of between three and six months would be an acceptable compromise. Eurofoods would have to establish a scheme for updating so that data suppliers could provide data at optional times and so on-line users would be aware of when the data base would be changed.

7.6. The rule of national data base centres in marketing Eurofoods products and services

There may be certain advantages in appointing national data base centres as marketing agents for Eurofoods products and services as the national centres could be closer to the market place. It would also increase the role of national centres in the operation of Eurofoods and may in fact provide them with a useful source of income. Such income may in fact lead to lower costs to Eurofoods for services provided under Sections 7.3 and 7.4.

7.7. Advantages to national data base centres of being involved in the Eurofoods system

National data base centres will derive a number of advantages from being involved with the Eurofoods data base system which will enable them to produce a better data base system of food composition data for use in their own country. For example, analytical data not yet available in their own country may be readily accessible in the merged data base. If the compiler has taken data from another European table, he could also be alerted if the source data is altered. Quite often, data in nutrient data banks are estimates and it will be quite easy for the compiler to compare estimates with data derived from the analysis of similar foods in other countries.

As Eurofoods will need to develop software and a variety of other services for users (see Sections 2.5, 2.7, and 2.8), many of these products and services would be of interest to users of national data bases of food composition data.

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REVIEW OF FOOD COMPOSITION TABLES IN EUROPE
Report of a Forum

MEMBERS: L. Bergström (Sweden/Norfoods); V. Veitl (Austria); D. Lemaître (Belgium); A. Bognár (FRG); A. Trichopoulou (Greece); E. Carnovale (Italy); A. H. Rimestad (Norway);
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Norfoods

Official Nordic co-operation exists in many fields at different levels. When it concerns food there are the Nordic Council of Ministers, Committee of Deputies; Nordic Committee on Food and Nutrition Policy, and several project groups within specific working groups. The committees and working groups have a more permanent status while the project groups are established to carry out and report on their specific tasks and are then replaced by other groups. Norfoods is a project group under the Nordic Working Group on Food and Nutrition. The group started its activities in 1982. The members are Denmark (Anders Møller), Finland (Maarit Ahola), Iceland (Olafur Reykdal), Norway (Arnhild Haga Rimestad) and Sweden (Lena Bergström). Computer experts have been linked to the group since 1985. These are Finland (Kimmo Louekari), Norway (Trond Ydersbond) and Sweden (Hernan Isakson). Anders Møller leads the computer work.

Norfoods' goals are to co-ordinate and to stimulate work on food composition tables, nutrient data base systems and food analyses in the Nordic countries. To achieve these goals the members work on several small projects, in addition to coming together for two meetings per year when current information is exchanged about the nutrition field in each Nordic country.

One of these projects is a dictionary of foods and dishes in English and in the Nordic languages. Scientific names will also be included. Norfoods will have some assistance from the merged Eurofoods nutrient data base, where Dr Arab already has the Nordic names, except the Icelandic ones. Another possible joint Norfoods and Eurofoods project is the reference list on nutrient losses and gains (NLG) in the preparation of foods. Norfoods members have already collected references on these and the references from Eurofoods NLG project could be included in a joint publication. A directory of Nordic nutrient data banks will also be published.

As work on Norfoods projects has progressed so plans have changed. That is the case with the nutrient database project. At first a common Nordic nutrient database consisting of two or three levels was suggested. Then it was considered more practical to set up a computer network, so that the national banks could be reached by other Nordic countries. But because of the high cost of on-line operations one solution which has been considered is tapes of the different Nordic nutrient data banks. These could be used in each country's own computer. Norfoods computer scientists have yet to decide upon the most appropriate plan.

For further information on Norfoods work, see the Wageningen report and the Norfoods poster, available from the author.

Austria

Austria, a small country with about 7.3 million inhabitants, has no national food composition table. There are, however, federal institutes for food analysis and research in each state of the country. There are also several analytical institutes within the food industry. Analytical data in food composition tables have not yet been published or collected nationwide. Such tables are needed, however, by scientists, government planners and industry.

The development of a nutrient data base

Concern with diet and nutrition-dependent disease at our institute raised an urgent need for a computerized nutrient data base. Therefore such a base was installed for calculation of energy and nutrient intake of our patients before and during therapy. Of special interest was the energy intake of: (1) obese subjects during their usual diet as well as when dieting to reduce body weight, (2) anorectic subjects, and (3) seriously ill patients during catabolism.

For our investigations of energy metabolism we need to know the exact metabolizable energy input during long-term whole body direct calorimetry using different formula diets Appropriate food composition tables are needed to analyse daily input of energy and nutrients.

Sources of our nutrient data base

Since an Austrian food composition table does not exist we used tables in the German language from other countries to form our database. These were the *Große Nährwerttabelle* (Cremer, 1983) and the *Food composition and nutrition tables* (Souci *et al.*, 1981).

When, as has become increasingly possible, we have been able to obtain the nutrient content of commercially prepared ready-to-eat food we have added these types of nutrient values as a separate part of our database. By courtesy of the food industry we received data on deep frozen food, heat-stabilized food, tinned food, and partially or totally ready prepared food. Where values are not available they are set at zero in the data base.

Values for energy, major nutrients, fibre content and minerals are generally available.

Another part of our nutrient data base contains dietetic products, formula-diets for tubefeeding and nutrient concentrates for artificial enteral feeding.

For calculation of nutritional intake it was found time-saving to calculate the nutrient values of Austrian standard recipes and give them them a separate place in the data base. At present, calculated values from Austrian sausage and 'Mehlspeisen' recipes are available. Other Austrian special recipes will be included.

Use of the nutrient data base

Energy content and amounts of 24 nutrients can be calculated using special programs when the amounts of food consumed are provided. Other programs can be used to calculate and differentiate the nutrient intake from animal and plant food sources.

From total consumed fat, the amount of polyunsaturated fatty acids is calculated. Total carbohydrate intake can be split into the amounts of mono-, di-, oligo- and polysaccharides. Ingested amounts of some vitamins (e.g., A, E, B_1, B_2, Niacin, C) and minerals (e.g., Na, K, Ca, P, Mg, Fe, Fl), as well as of fibre and cholesterol, can be determined.

Of special interest in the diet are non-nutrient substances possibly associated with the incidence of certain diseases. At present a special table for food purine content or uric acid equivalents is available. Other tables will be developed step by step.

On a large scale the nutrient data base was used to investigate supply and consumption of food at different business canteens to calculate input of energy and nutrients. A small program is used for fast calculations of single recipes and a large one for calculations in nutritional studies. Both programs offer choice up to 24 nutrients.

Special tables may also be used here. A modifying program can be used to recalculate standard recipes for defined dietetic use.

Conclusion

For the moment the proposed Austrian food composition table is an incomplete structure. However, by using all national sources of analytical data and through cooperation with Eurofood, useful tables will soon be developed. In the absence of a national Austrian table, our nutrient data base provides a beginning for an Austrofood composition table. Although values have not been published as a whole interested users with their own computer facilities may however obtain a food code list for their own purposes.

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Belgium

The following information can be given on the progress made in our national food composition tables since the Eurofoods Workshop in Wageningen in May 1983. We mainly use the Dutch table as our country still does not have a specific Belgian table. The efforts of Eurofoods have brought about the establishment of a commission aiming at the realization of the 'NUBEL table'.

The following parties are concerned. The authorities (Ministry of Health) will provide all available food analyses as well as financial support. Officially recognized laboratories and institutions (universities, research institutions) will carry out analyses. The food industry will provide analytical data while regarding the NUBEL project as beneficial to the industry as a whole.

The *Belgian Association of Dietitians*, which is the initiator of the project, will give its advice on the inclusion of foods normally to be found in the Belgian diet.

This NUBEL table will be used mainly by: (1) all those who are concerned with the healthy diet of individuals in the community (nutritionists, dietitians); (2) those specifically concerned with the food of patients (dietitians, nurses, physicians); (3) the general public (using a simplified version at a later stage), and (4) computers of software packages for the evaluation of nutritive values of foods.

Federal Republic of Germany

The third edition of the Souci-Fachmann-Kraut tables has been published (Souci *et al.*, 1987). Alterations were made by introducing new foods and as to food components and to nutrient density, as follows. The tables were up-dated by the introduction of *new foods* in the following food groups: milk and milk products (e.g. cheese varieties); fats and oils (margarines); meat without fat; fish and molluscs; cereal, cereal products and oil seeds; vegetables and vegetable products, cooked vegetables and exotic fruits. Important alterations to the inclusion of *food components* are the changes of 'carbohydrate' and 'crude fibre' to 'available carbohydrates' and 'total dietary fibre'. Several new minerals and trace elements (nitrate, nitrite, silicon, bromine, tin, vanadium, aluminium), vitamins (individual tocopherols), amino acids (free amino acids in fruits and fruit juices) have been included, as have phytic acid, sterols and biogenic amines. Values for *nutrient density* were added to enable better assessment of the nutritional quality of the food.

Greece

After the Wageningen meeting the progress made on the Greek food composition tables has focused on: (1) computerizing the existing data and classifying them according to the main groups of the Eurocode; (2) expanding the number of food entries and food components, and (3) preparing a corrected and enlarged new edition of the tables with an English translation.

Italy

The present Italian food composition tables, published by the National Institute of Nutrition, were produced in 1976 according, as much as possible, to the guidelines prepared by Southgate (1974), utilizing either original analytical data or carefully selected literature data. During these nine years the tables have been widely utilized in different areas (food consumption surveys, nutritional surveys, research, dietetics, agricultural and economic planning).

The main problems encountered by the users have been (1) lack of data on the composition of cooked foods and recipes; (2) lack of data on some nutrients, e.g. dietary fibre, sodium, potassium and zinc, folic acid and vitamin E; (3) expression of available carbohydrates as monosaccharides; and (4) lack of the range of variability of the nutrients and the number of samples analysed.

For many reasons, mainly economic in recent years, the updating of the tables consisted only in the addition of missing values (mainly vitamins). Only recently has a new edition of the table been planned, along similar general lines to the present edition (grouping of foods with separate tables for amino acids and fatty acids, etc).

The tables will be extended taking into consideration the needs of the users and the availability of new data. The *selection of nutrients* will use dietary fibre instead of crude fibre, will separate carotenes and retinol and will add vitamin E, vitamin D, folic acid, vitamin B_{12}, sodium, potassium, zinc and magnesium. The *selection of foods* will be carried out according to the results of a survey conducted by our Institute on 15 000 households. The food items with higher frequency of consumption will be chosen among the 12 000 items collected. The *source of data* will be either analytical (from the Institute, other public laboratories, or food companies) or from literature (original publications). Data borrowed from other tables will be reduced as much as possible. As far as *composite dishes* are concerned the selection of items will be carried out on the basis of the previously mentioned survey. The recipes will be taken from an “ad hoc” publication of our Institute. Our present *code* will be used with minor modifications. Useful *supplementary tables* will be inserted, e.g. conversion of units (spoons, cups, to grams); nutrient losses during cooking and processing, and weight changes during cooking.

Southgate, D. A. T. (1974): *Guidelines for the preparation of tables of food composition*, Basel: Karger.

Norway

In Norway we have one official food composition table called the National Nutrition Council's Food Composition Table.

The collection of data and editing of the tables has been the responsibility of the National Society of Nutrition and Health. It was first published in 1958, and the 5th and latest edition was published in 1984. The table comprises about 750 foods including some dishes and provides data on 14 nutrients. The table is intended to be a tool for various educational and informational activities. It is also available on diskettes.

This year we have designed a system for a nutrient data bank on the mainframe computer at the University of Oslo. This bank is designed to contain data on 122 nutrients and to include references to all the individual food values, and recipes for dishes and products. It is possible to calculate nutrient values from recipes and store these.

We do not intend to link any advanced calculating system suited for dietary research to this data bank as the Section for Dietary Research at the University has their own data bank and software suited for this purpose.

Until now there has not been a laboratory that has been responsible for analysing foods for the food composition tables. The data have been obtained from many different laboratories. This year, however, the most advanced laboratory in Norway dealing with food analyses will probably accept the responsibility of analysing food for this purpose.

Poland

For several years the Institute of Food and Nutrition has investigated the nutrient values of basic Polish foods. Additional analyses are carried out at different laboratories and institutes. The results, as well as foreign published literature on this subject, are collected by the Institute of Food and Nutrition.

The recent tables prepared by J. Piekrska & M. Los-Kuczera (1983) contain almost one hundred food items from 38 food groups, as well as mixed dishes.

The values of energy, water, protein, fat, total carbohydrates, fibre, ash, calcium, phosphorus, iron, magnesium, retinol, carotene, retinol equivalent, thiamin, riboflavin, niacin and ascorbic acid are included. It is important, that for the first time in this publication, energy and nutrients are given for alcoholic and nonalcoholic beverages. Percentage of waste and where applicable, loss, of nutrient values during the culinary preparation of raw products are estimated.

A second part of the Polish food composition tables (1983) is at present in the process of publication by PZWL. It will also include more detailed information on minerals, vitamins, fatty acids, cholesterol, amino acids for the same products which were analysed in the 1983 edition food tables.

Piekarska, J. & Lós-Kuczera, M. (1983): *Sktad i wartość odzywcza produktów spozywczych*, Warsaw,: PZWL.

Portugal

The first Portuguese food composition tables edited by Goncalves Ferreira & Silva Graça were published in 1961, and the third and last edition in 1977. All the tables were published by the National Institute of Health. The data on nutrients were based on direct analyses of food samples carried out by the Food Chemistry Laboratories at the National Institute of Health (Lisbon and Oporto).

At present the Nutrition Research Centre and the Food Chemistry Departments of the above Institute have set up the task of revising and extending the last edition of the Tables. It is planned that the new edition will retain the features of the earlier editions, and all the values given will be provided only by direct analyses. Some new foodstuffs and nutrients will also be added.

Two new supplements are planned. The first, on foods for special nutritional use, will include dietetic foodstuffs for children and other special dietary foods. Data on the analyses of dietetic foodstuffs for children, infant milk formulas, dietetic cereal formulas and other baby foods, have recently been published by the various Food Chemistry Departments. A second supplement will also be based on the work of the Food Chemistry Departments who are now starting to carry out the cooking and analyses of some Portuguese cooked foods.

The third edition of the Portuguese food composition tables formed the basis of a reduced nutrient data base, that, during 1984, was organized by the Nutrition Research Centre. This data base has data on 12 nutrients for 104 food items, and until now, has been only used by the Nutrition Research Centre to evaluate dietary survey data.

Spain

Since the Spanish food composition tables were first published in 1980, an attempt has been made to increase the data contained, especially to include nutrients that were not initially considered. The third edition of the tables, which is now imminent, will therefore include new data drawn from reliable bibliographical sources on the lipid composition of a number of foods, especially fatty acid composition including total saturated fatty acids, total polyunsaturated fatty acids, oleic, linoleic, linolenic, stearic, palmitoleic, myristic, palmitic and arachdonic acid, and cholesterol. These data are already being used in work we are doing in a national nutrition survey to discover the type of fat consumed in the Spanish diet. This is being jointly conducted by the Institute of Nutrition and the National Institute of Statistics, on 25 000 families that are representative of the country. Also being studied is the type of fat consumed in areas of Spain in which the highest levels of blood pressure in Europe are recorded.

The sodium and potassium content of the foods listed in the tables will also be included.

As far as the number of foods included in the tables are concerned, we believe they encompass virtually all the most significant, basic, single raw foods consumed in Spain. However, it is an acknowledged fact that there are sometimes large differences in the nutrient content of a food because of the processes it has undergone, especially in the home. We are expanding this information in the study that is being carried out in this institute on the composition of mixed foods, after they are cooked. This involves analysing some of the mixed dishes that are most frequently eaten in parts of Spain, such as paella, dishes made with pulses and, above all, a variety of fried fish. The macronutrients in these dishes are determined, including the NPU of the protein, to find out how the amino acids of the constituents of the mixed dishes interact. In addition, fatty acids and some vitamins are analysed.

Modern methods of keeping foodstuffs mean that many of them are no longer purely seasonal, but there is no doubt that the same product harvested or caught at different times of the year may contain very different amounts of nutrients. We have already studied the composition, at four different times of the year, of 12 species of fish that are eaten fresh. Considering the extend to which fish forms a part of our diet, determining the qualitative and quantitative composition of its fat could prove to be of the utmost importance.

The work to improve upon the previously limited information supplied in these tables has been encouraged by the growing number of people and institutions using them.

United Kingdom

In the seven years since the publication of the 4th edition of McCance and Widdowson's ‘The composition of foods’ (Paul and Southgate 1978; Paul *et al* 1980), much additional information relating to the tables has been published and major studies supplying new compositional data have been commissioned by the Nutrition Section of the Ministry of Agriculture, Fisheries and Food, who now have the sole responsibility for the food composition tables. The majority of the analyses have been carried out at the Laboratory of the Government Chemist in London. A completely new section to the tables, Immigrant Foods, has been published as the second supplement (Tan *et al* 1985). Details have been published of the composition of breads and cereals, and of seven trace elements (Se, Mn, Cu, Zn, I, F, Cr) in foods and of vitamin A in animal foods. Potatoes were analysed at the Food Research Institute, Norwich, and milk and milk products mainly at the National Institute for Research in Dairying (now Food Research Institute) at Reading. The results from these studies will be incorporated into future supplements of the tables.

Minor errata in 15 items in the 4th edition have been identified, and the weight loss on cooking of all the 69 cooked dishes in the tables is now provided, together with minor corrections to nine of the recipes (Paul *et al* 1986).

Paul, A. A. and Southgate, D. A. T. (1978). McCance and Widdowson's *'The composition of foods'*, 4th edition. London: HMSO.

Paul, A. A. Southgate, D. A. T. & Buss, D. H. (1986): McCance and Widdowson's *'The composition of foods'*: supplementary information and review of new compositional data. *Hum. Nutr. App. Nutr.* **40A,** 287–299.

Paul, A. A. Southgate, D. A. T. & Russell, J. (1980): *First supplement to McCance and Widdowson's The composition of foods. Amino acid composition (mg per 100g food) and fatty acid composition (g per 100g food).* London: HMSO.

Tan, S. P., Wenlock, R. W. & Buss, D. H. (1985): *Second supplement to McCance and Widdowson's The composition of foods. Immigrant foods.* London: HMSO.

SHORT COMMUNICATIONS AND WORKSHOP REPORTS

Nutrient analysis: report of a workshop

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1. Eurofoods interlaboratory trial 1985 on laboratory procedures as sources of discrepancies between food tables

The draft report of this interlaboratory trial was distributed to all participants and was discussed in detail by Peter Hollman (State Institute for Quality Control of Agricultural Products, Wageningen). The between laboratory variations observed in this interlaboratory trial were unacceptably high for total fat, available carbohydrates and fibre. It was felt that differences in methodology were partially responsible for the high variations in total fat. There were a number of different methods used for available carbohydrate. These differences are important contributions to the between laboratory variation. For fibre there are well recognized differences in principle and in resulting analytical values between the several methods used. For example, the neutral detergent method does not determine several components that other procedures include and as a result gives lower values for those samples that contain significant amounts of those components. It was recommended that fibre data be evaluated using only values from the Prosky-Asp methodology as this procedure is being tested for official AOAC approval.

Based on the results of this interlaboratory trial, it was proposed that Eurofoods initiate a programme to develop several suitable reference materials characterized for these important nutrient constituents. Peter Wagstaffe of the Community Bureau of Reference (BCR), CEC, Brussels, presented some discussion on BCR activities and interests in this area. It was agreed that a proposal be developed for a joint programme between Eurofoods (Hollman/Katan at Wageningen) and BCR (Wagstaffe, Brussels) to produce appropriate reference materials in this area.

2. In-house quality assurance programmes

Discussion of this topic led to a number of recommended areas in which Eurofoods should encourage further activity: Development and use of in-house quality control materials to carry out and document proper quality assurance of analytical data; recommendations for inclusion of more analytical detail in publications; informal inter-laboratory exchanges of samples using available inhouse quality control materials, and translation from Swedish of extensive guidelines developed by the Swedish National Food Administration for a Good Laboratory Practices programme for nutrient analysis.

3. Inventory of Eurofoods resources related to food composition

A listing of laboratories and personnel associated with nutrient analysis and food composition should be compiled. Initially this list would include the laboratories involved in the Interlaboratory Study and the participants in this Eurofoods meeting. It should be expanded to include additional laboratories and resources.

4. Check sample programmes

It was generally agreed that appropriate check sample programmes would potentially have significant merit in improving analytical values for nutrient analysis within the

Eurofoods community. At present the Swedish National Food Administration has an active check sample programme where two to four samples are sent once a year to 35 laboratories. There would be a possibility of including some additional Eurofoods laboratories in this programme. For details of this programme contact Dr I. A. Torelm, Swedish National Food Administration, Box 622, Uppsala, Sweden.

Dr P. B. Czedik-Eysenberg, (Chairman, Working Party Food Chemistry of the Federation of European Chemical Societies, Vienna) has agreed to conduct a survey of interest and feasibility of establishing a check sample scheme for Eurofoods laboratories.

5. Meeting of analytical committee

It was generally felt that the projects proposed did not require a formal meeting in 1986. Persons responsible for the various proposed projects would handle necessary personal contact, communications and planning to initiate and carry out the projects.

Using computers in nutritional epidemiology

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The problems of handling nutritional data specific to epidemiological surveys were discussed. The main problem is that surveys are conducted on very large numbers of subjects (representative population samples). It is recognized that there is no ideal dietary survey method, but whichever method is used, data must be converted to a form which will enable calculation of nutrient intakes by computer. At present this appears to be done mostly by manual coding. Among the survey team there may be only one experienced nutritionist and it is almost impossible for one person to collect and code all the data accurately within the time available. Therefore, additional trained fieldworkers and coders are required. Manual coding introduces the possibility of a large number of errors, even when the coding is done by an experienced nutritionist, simply due to the volume of data collected. These errors are of course reduced by code-checking conducted by a nutritionist, but because of the number of subjects being studied, this is extremely time-consuming and will probably not eliminate all the errors. Transfer of the coded data to computer is only a minor source of effort since data entry is normally verified.

The possible uses of computers as more efficient tools to overcome these problems were discussed. Entry of data by the coder into a microcomputer for pre-processing prior to transfer to a mainframe computer for storage or nutrient calculation is one possibility. The food code or name could be entered and verified, followed by the amount. Several systems of this type have already been developed and were demonstrated during the poster presentations. These were, however, designed for use by dietitians and nutritionists. For epidemiological surveys a system suitable for use by non-nutritionists would be more valuable.

Where recall dietary methods are used, it may be possible for interviews with subjects to be conducted so as to enter data directly into a microcomputer, as was done in the USA National Health and Nutrition Examination Survey (NHANES). In this study, subjects were asked questions about their food intake, the program being menu-driven i.e. each question was dependent upon the answer to the previous one. This approach eliminates observer variation and the need for data coding, but requires that the subject attend a clinic and that a nutritionist be present to determine portion sizes.

Where dietary recording methods are used, depending upon the purpose of data collection and the nutrient to be studied, the Food Recording Electronic Device (FRED) may be useful (Stockley *et al.* in press). This device eliminates the need for coding of data, but foods need to be grouped and composite dishes may be a problem.

For both recall and recording methods, data could be entered into a microcomputer by a trained person, who need not be a nutritionist, if an adequate software package were available. In order to be useful, a large part of the skill of the nutritionist would need to be built into it. This requires a first-class liaison between the programmer and the nutritionist. Existing packages are slow if food names rather than code numbers are entered, so that the speed of the search procedure would need to be increased. For foods and composite dishes not present in the food composition tables, one or more substitute codes with the same nutrient composition can often be used and a list of those occurring most frequently kept on file. Amounts of foods could be entered not only as weights but as household measures and converted to weights by the programme. Range checks on the weights of foods entered are an essential part of the pre-processing system to identify possible gross errors, e.g. dry weights coded as liquids or *vice versa.* Such checks could and should be incorporated into all existing programs where data are coded manually.

The main disadvantage of this proposed pre-processing system, apart from the time and cost required to develop the software, is that nutritionists become more remote from the raw data and errors are more difficult to detect on computer print-outs. The main advantages are that coding errors and the number of hours a nutritionist is required would be reduced. In the longer term, by reducing the clerical load on qualified nutritionists, their efficiency would be enhanced.

Nutrient losses and gains: report of a workshop

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The workshop started with a short survey of the results achieved in the different fields; recipe calculation systems; recipes, analysed, calculation and corrected with NLG factors; NLG research; NLG references; and NLG data base (see these proceedings pp. 8–12).

Dr Bognar described how to use yield factors for energy and nutrients, see appendix.

In the first part of the workshop the following activities for 1985–86 were suggested; collection of retention factors connected with the different cooking methods; collection of food yields for different dishes; collection of 100 recipes for the most common dishes consumed in each European country, and — if possible — inclusion for the recipes of the following parameters; cooking procedures, weight losses, cooking time and cooking temperature.

The discussion then turned to the different parameters in the cooking of food. At the Swedish National Food Administration a pilot data base for storing information on these different parameters has been created. (Mr Hernan Isakson describes the model on pp. 78–79 of these proceedings).

Conclusions

Recommendations for the future work, suggested above, were made. (1) It was suggested that the group should start with the compilation of the 100 recipes for the most commonly consumed dishes in the different European countries. Information on cooking method, procedures, time, temperature, weight loss or food yield should be collected. (2) Analytical and calculated nutrient values for the dishes should also be collected and analysed. (3) Standardized recipe forms should be made. (4) The descriptions of the different recipe calculation systems must be more informative, therefore a new inventory must be performed. (5) The collection of references on NLG factors and related topics must continue.

After discussion of the factors to be taken into account it was finally decided that only 25 recipes for the most common dishes consumed in each European country should be collected. From these recipes ten recipes, representing different food groups and cooking methods, will be chosen. All possible information will be collected about these dishes. The dishes will be analysed and calculated for nutrients on European recipe calculation systems. The results will be analysed.

These results and the results from the NLG project 1985, together mainly with Dr Bognar's research on NLG, will be the base for NLG factors to be suggested at the next Eurofood meeting.

Appendix

Methods for the determination of nutrients and energy in cooked dishes
(See: Bognar, Karg: Empirical comparison of different methods for the determination of the energy and nutrient contents of dishes, BFE-Bericht, Karlsruhe 1985)

1) A = analysed = Z (i,p,k)

the content based on chemical analysis, of constituent *i* in 100 g of recipe *p* of cooked dish *k* edible portion.

2) C = calculated = C (i,p,k)

the content of constituent *i* per 100 g cooked dishes (p, k) are calculated on the basis of the raw food composition-tables (Souci, Fachmann, Kraut, Germany) and the data for the recipe *p* used for dish *k* or chemical analysis of a sample of dish *p, k* in raw state. Then the changes caused by processing in the weight are taken into account using the yield factor for weight for dish *p, k.*

$$C\ (i,p,k) = \frac{X\ (i,p,k)}{d\ (k)} \qquad (1)$$

$$X\ (i,p,k) = \sum_{j \in J(p,k)} \frac{X(i,j)}{100} \cdot \frac{U(j,p,k)}{U(p,k)} \cdot 100 = \sum_{j \in J(p,k)} X(i,j) \cdot \frac{U(j,p,k)}{U(p,k)} \qquad (2)$$

X	(i,p,k) =	The constituent *i* in 100 g of recipe *p* of dish *k* in the raw state.
X	(i,j) =	The content of constituent *i* in 100 g of ingredient *j* (edible part) from Nutrition Tables
U	(j,p,k) =	Quantity of ingredient *j* in grams in recipe *p* for dish *k* for raw food in the raw state (edible part)
J	(p,k) =	Index quantity of the ingredients contained in recipe *p* for dish *k*

U (p, k) = Total quantity of the ingredients in grams in recipe *p* for dish *k* in the raw state, where

$$U(p,k) = \sum_{j \in J(p,k)} U(j,p,k) \quad (3)$$

To determine the yield factors for weight the following data are needed:

U (p,k) = Total quantity of the ingredients in grams in recipe *p* for dish *k* in the raw state (edible part)

V (p, k) = Total quantity in grams of the ingredients in recipe *p* for dish *k* in the cooked state (edible part)

Then d (p,k) is the yield factor for weight for recipe *p* for dish *k* where

$$d(p,k) = \frac{V(p,k)}{U(p,k)} \quad (4)$$

and d (k) is the average yield factor for weight for dish *k* where

$$d(k) = \frac{\sum_{p=1}^{P_k} d(p,k)}{P_k} \quad (5)$$

P_k = Number of recipes

3) D = calculated from "C" using specific yield factors d (i,k) for nutrients and energy = D (i,p,k):

$$D(i,p,k) = C(i,p,k) \cdot d(i,k) \quad (6)$$

To determine the yield factors for constituents the data for Z (i,p,k) and X (i,p,k) for *p* = 1, . . ., P_k are needed. d (i,p,k) is the yield factor for constituent *i* in recipe *p* for dish *k* where

$$d(i,p,k) = \frac{Z(i,p,k)}{X(i,p,k)} d(p,k) \quad (7)$$

and d(i,k) is the average yield factor for constituent *i* in dish *k* where

$$d(i,k) = \frac{\sum_{p=1}^{P_k} d(i,p,k)}{P_k} \quad (8)$$

A computerized method of prospectively measuring food intake in man

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The most usual method for prospective intake measurement is the weighed inventory. However, there are a number of problems associated with the use of this method. These include interference with habitual dietary patterns, low response rates from the less literate members of the population, and the time consuming nature of the subsequent coding of the records and transferral of data to the computer.

A system has been developed which eliminates the need for a subject to read a balance or use a notebook, stores quantitative data for a period up to three weeks, and whereby at the end of the survey period the data can be transferred directly to a host computer holding food composition data, for the calculation of nutrient intake. The system (known by the acronym FRED, Food Recording Electronic Device), consists of an electronic balance, interfaced to a microprocessor. This is housed in a central unit of which a touch sensitive keyboard forms the upper part.

Each key can be labelled with the name of a food, or a food group. Eighty-four food groups have been developed from McCance and Widdowson's *The composition of foods'* (Paul & Southgate, 1978), and have been validated for the estimation of energy, protein, and fat consumption. Data from 251 24-hour dietary records were used to compare intakes calculated using either the food groups or the tables from which they were derived, with duplicate diet analyses. The mean differences are shown in the Table. The correlation coefficients between analysed and calculated results were similar for both methods of calculation.

The FRED has been tested in 29 subjects, who used the system and at the same time kept a conventional seven day weighed diary. Trials of the method in groups of people who typically do not respond well in diary studies, are currently underway.

This alternative approach may provide a cost-effective means of prospectively collecting quantitative dietary information in large groups of subjects.

Table. Overestimation (+) and underestimation (-) of analysed results using food composition tables or food groups, with coefficient of variation (CV). *n* = 251.

	Mean analysed value	*Food tables*	*Food groups*
Energy	2168 kcal	-1.9%	-1.5%
(CV)	(34)	(33)	(33)
Protein	71.0g	+2.0%	+0.3%
(CV)	(30)	(30)	(32)
Fat	96.6g	-8.7%	-8.5%
(CV)	(35)	(36)	(36)

Reference

Paul, A. A. & Southgate, D. A. T. (1978): *McCance and Widdowson's The composition of foods'*, 4th edn. London: H.M. Stationery Office.

Agraterm: proposed linguistic network for Dutch agricultural institutions

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What can a linguistic data bank do? An electronic and organizational network can combine the functions of:

(1) General dictionaries: spelling checks; meanings of words
(2) Bilingual dictionaries: language equivalents of given terms
(3) Technical glossaries: meaning of terms used by specialists in a given discipline
(4) Terminological and nomenclatural recommendations: recommended and deprecated ways of expressing given concepts (together with the authority making such recommendation)
(5) Recommendations on symbols and notations
(6) Dictionaries of abbreviations
(7) Dictionaries of idiom: examples of usage of words and terms, addressed expecially to linguistic traps faced by non-active users
(8) Style manuals: confused word-pairs; wooly language
(9) Bibliography of dictionaries and glossaries: Where am I likely to find information about a term in a given discipline?
(10) Information retrieval thesauri: significant terms for description of a subject (of a publication) and the relations between terms. This last function will need refinement for a data bank on food composition.

In the Netherlands, we have about 100 agricultural (including food industry) institutions, often working in several languages for scientific communication, trade and policy matters. Many individuals and institutions are involved in terminological commissions, in the compilation of glossaries, thesauri and classifications, and in communication skills.

The extent of institutional involvement is being surveyed by questionnaire. Various files have been tested with a data base management system (Synergy on DEC 350). We hope to test termbank software being developed at Manchester (UMIST) and at Heidelberg.

Ultimately the linguistic resources should be interchangeable between active users of the system, with mechanisms for interaction between different groups of experts and with continuous improvement in the content of the files. Active and passive users could have access on line or by exchange of discs.Experiments will continue on DES 350, IBM Professional and DEC VAX.

Calculation of the fatty acid content of food

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The accurate calculation of the fatty acid content of foods faces two important problems. Firstly, there is dearth of information on the fatty acid composition of foods, moreover, much of the published data on the fatty acid composition of foods is inaccurate, and secondly, there are enormous variations in fatty acid composition between the same types of food.

Data base accuracy
Published information on the fatty acid composition of foods frequently contains important inaccuracies.

(a) Long-chain n-6 and n-3 essential fatty acids (EFA). The long-chain EFA are sometimes listed when almost certainly absent. This is likely to be due to the fact that the fatty acid composition of the food fat is usually determined by gas-liquid chromatography (GLC). Slow running components on GLC (long-chain fatty acids with unusual groups of configuration, or possibly compounds other than fatty acids) may be confused with the long chain EFA. Equally, the long-chain EFA may not be listed when present, e.g. in animal products such as milk, meats and meat dishes in McCance & Widdowson's tables of food composition. The high biological potency of the long chain EFA and their relevance to questions concerning circulatory and other diseases mean that these inaccuracies in their assessment should not be ignored.

(b) Positional and geometric isomers. Data on the contents of fatty acid isomers of foods are absent from published tables of food composition. Other sources of information give a very incomplete picture of this significant aspect of commonly consumed foods. The recommendations of the COMA (1984) report have emphasized the need to monitor the intakes of fatty acid isomers, which it suggests should be considered together with the saturated fatty acids. However, conventional analytical techniques do not separate the isomers from other unsaturated fatty acids.

There is no solution to problems (a) and (b) other than to carry out detailed analyses of the fatty acid content of those foods for which information is required but unavailable.

Fat subcoding
Many foods incorporate large amounts of added fat, e.g. fried foods such as chips, and home or commercially prepared foods such as cakes. The nature of the fat used in these foods will vary with individual choice of cooking fat, or with restaurant, or with the brand of food.

To accomodate this variability, the NLCM diet analysis computer programs incorporate a ‘fat subcoding' routine. All foods containing added fat allow selection for both the amount and type of added fat. The amount is expressed as a percentage, e.g. 11% for chips indicates that 11% of the weight of cooked chips is added fat. Standard % values for most common foods may be read from file automatically.

The fat subcoding is done during entry of a subject's food record onto the computer. For example, entering the code and amount for chips causes the additional questions to follow: Code for fat? % fat?

With this information, the correct amounts of the food and the selected fat are computed, and the energy and fatty acids etc. derived from the fat are added to the data for a ‘no fat added' chip (the latter data obtained by calculation).

The use of this technique answers the problem of the variability of the fat added to foods, and importantly, also greatly simplifies the problem of updating the fatty acid data for these foods.

Committee on Medical Aspects of Food Policy (1984): *Diet and cardiovascular disease.* London: HMSO.

Computer program for use with phenylketonuric children

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KLEM (Institute for Clinical Nutrition and Medical Research) and NUME (Nutrition Medical Products) have in co-operation with Elisabeth Kindt, dietitian at the National Hospital and Professor Sverre Halvorsen at the Oslo City Hospital, developed a computer program for children with phenylketonuria (PKU). A prototype of this programme was demonstrated at the Eurofoods meeting.

PKU children are strongly dependent on a phenylalanine controlled diet. If the child's diet is not monitored as early as possible, mental retardation is likely to occur. The recommended intake of phenylalanine for these children will vary, as the same intake of phenylalanine may have different effects on plasma concentration of phenylalanine in different children. Each child has to be treated individually and is dependent on continuous medical and dietary support.

The intention of the PKU program is to help parents and children to self-monitor the phenylalanine intake in a simpler and better manner. Besides, the program gives the child an opportunity to take on the responsibility for his or her diet. This is even more important when the child grows older and the diet becomes less restrictive.

The program is developed for Commodore 64 and is available on tape as well as diskette. The program monitors the phenylalanine content of the diet and relates this to the child's allowance of phenylalanine. It is also possible to monitor the energy, fat and protein content if desired.

KLEM is an independent Norwegian research institute. An important aspect of KLEM's work is to develop new tools in the treatment of dietary disorders. KLEM co-operates with NUME, which is responsible for production and marketing of the computer programs. These will be tailored for various other countries, in which KLEM is collaborating with nutrition consultants.

Dietary assessment using a microcomputer

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In 1982 work started on the nutrient data access system ‘Microdiet’. Specifications were drawn up according to dietitians' and nutritionists' requirements and software developments have been undertaken according to their requests and in line with advances in nutritional science. Early stages of the work are described and some recent developments outline by Bassham, Fletcher & Stanton (1984).

The availability of specially designed, easy-to-use microcomputer software and experience in its use have led to changed expectations of what dietitians and nutritionists can achieve and also enabled them to deal with heavier workloads at a time of increasing public awareness and medical interest in the significance of diet.

Inter-active microcomputer access has also changed users' qualitative expectations. For example, in dietary assessment work, comprehensive and detailed nutrient analysis is now taken for granted and extra facilities are requested as a result of learning about computers' capabilities both from experience and from attendance at training courses.

The first users of 'Microdiet' who were involved at the project's inception already did simple dietary assessments (usually for as few nutrients as possible) by hand. The original software specification translated familiar manual processes to microcomputer. Nutrient totals and daily averages were required for comparison with appropriate intake recommendations. Soon, users asked that recommendations be computerised for easy direct comparison and software was written so that standards could be entered and then displayed alongside actual nutrient intakes.

Further analysis options have been added making a total of twelve in the nutrient accumulation module of 'Microdiet'. In response to the NACNE recommendations (Health Education Council, 1983), analysis of energy intake from fat, protein, carbohydrate and alcohol is often required. An energy profile is given and the user may alter the conversion factors if this is appropriate. Similarly the p:s ratio for fat consumed is displayed in addition to an intake analysis by individual fatty acids. The latest routine allows nutrient totals to be filed for future use and for manipulation by other software packages. Within a month of this facility being available, requests were received for further developments of this type.

Summary. Initial programme design and later developments have been undertaken with the aim of meeting dietitians' and nutritionists' requirements and frequent continuing contact with many endusers have maintained the professional value and usefulness of the software. Progress in hardware availability and software use has made end-users more aware of the possibilities offered by microcomputers. There are now tremendous opportunities for innovation and development in this area.

Bassham, S., Fletcher, L. R. & Stanton R. H. J. (1984): Dietary analysis with aid of a microcomputer *Journal of Microcomputer Applications 7, 279.*

Health Education Council (1983): A discussion paper on proposals for nutritional guidelines for health education in Britain.

Dietary habits and food contamination cause differences in heavy metal intake

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Intakes of heavy metals are estimated in many countries, due to relative closeness of intake rates to the acceptable daily intakes (ADI) established by WHO. However, the elevated heavy metal exposure is considered as a consequence and an indication of environmental pollution. Methods used in estimating food contaminant intakes and results obtained vary considerably. It is seldom discussed whether the variation of intake rates between countries is due to differences in food consumption or in environmental contamination rate between countries.

The present comparison of heavy metal intakes between Finland, West Germany and Japan suggests that intake of lead, cadmium and mercury is lower in Finland than in the other two countries. Compared to West Germany the intakes in Finland are three to four times lower. The intake of cadmium in West Germany and in Japan are 70 and 65% of the ADI-value. In these countries among some groups of consumers the ADI is probably approached or exceeded, due to the fact that the intake of heavy metals varies considerably within the population. The content of lead and cadmium in single food items were compared and again Finnish food seems less contaminated than food of other countries. The lead content of wheat, potato and meat is one and a half to six times higher in West Germany and Japan compared to Finland. The largest difference is observed in lead content of bovine liver. Liver is known to accumulate lead and cadmium.

Vegetables and fruits contribute substantially (33–38%) to the total intake of lead in all the three countries. Vegetables are exposed to lead contamination from exhaust fumes of cars. Although the consumption of these food groups is almost similar in Finland and West Germany, the lead intake through vegetables and fruits is three times higher in West Germany than in Finland (70 and 22 µg/ d respectively). This illustrates the effect of environmental contamination.

On the other hand a part of the differences in the intake of lead and cadmium is explicable by food consumption habits. Fish and seaweed cause remarkable exposure in Japan, because they are an essential part of Japanese diet. Germans consume much beer and this is reflected in the intake of lead. Finns prefer milk and cultured milk instead, which contain ten times less lead than the German beer.

Dietary studies in the Caerphilly Heart Disease Survey

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The Caerphilly Heart Disease Survey comprises a whole programme of studies based in Caerphilly, South Wales (The Caerphilly and Speedwell Collaborative Group, 1984). A considerable emphasis is being placed on the investigation of dietary factors of possible importance. Every subject was asked to complete a food frequency questionnaire and a representative subsample (665) completed a seven day weighed dietary record. Preliminary results of the investigation of dietary determinants of plasma lipoproteins, fibrinogen and blood pressure using weighed intake data from 117 men were presented (Fehily *et al.*, 1982). In addition, nutrient intakes calculated from questionnaire data were compared with those from weighed intake data. Since the preliminary report on 119 subjects (Yarnell *et al.*, 1983), the nutrient calculations have been altered to include all foods on the questionnaire which contain a particular nutrient, rather than just the main sources. This has reduced the mean differences between the two methods (see Table). These differences are now small but, except for fat, starch and ascorbic acid, still statistically significant. The correlation coefficients and percentage of subjects classified in the same and in opposite thirds of the distribution were similar to those reported previously.

Table. *Comparison of nutrient intakes calculated from questionnaire with those from 7 day weighed intake records of 665 men*

Nutrient (g/d)	*Questionnaire*		*Weighed intake*	
	Mean	*(SD)*	*Mean*	*(SD)*
Energy	2300	(592)	2405	(588)*
Protein	73	(18)	82	(19)*
Fat	100	(30)	99	(28)
Starch	156	(58)	160	(51)
Sugars	95	(39)	111	(56)*
Cereal fibre	8	(5)	9	(5)*
Fruit and vegetable fibre	8	(3)	11	(4)*
Ascorbic acid (mg/d)	51	(21)	52	(29)
Alcohol	29	(41)	26	(33)*

$^*P < 0.001$

The Caerphilly and Speedwell Collaborative group (1984): Caerphilly and Speedwell Collaborative heart disease studies. *J. Epidemiol. Commun. Health* ***38,*** *259.*

Fehily, A. M., Milbank, J. E., Yarnell, J. W. G., Hayes, T. M., Kubiki, A. J. and Easthem, R. D. (1982): Dietary determinants of lipoproteins, total cholesterol, viscosity, fibrinogen and blood pressure. *Am. J. Clin. Nutr.* ***36,*** *890.*

Yarnell, J. W. G., Fehily, A. M., Milbank, J. E., Sweetnam, P. M. and Walker, C. L. (1983): A short dietary questionnaire for use in an epidemiological survey: comparison with weighed intake records. *Hum. Nutr.: Appl. Nutr.* ***37A,*** *103.*

Model of a nutrient losses and gains database

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It is known that food treatments, including food preparation, storage, preservation, industrial processing, transport and even “no-action”, may affect the nutrient content of foods. It is also known that even bioavailability of certain foods is affected in the presence of other foods and substances, or when foods are treated in different ways. It is in the nutritionists' interest to ‘optimize’ food treatment, and find methods which destroy less nutrients and/or eliminate most toxic substances contained in foods. The food industry is also interested in optimizing industrial processes and researchers need more and better information on foods, nutrients and how these are affected by treatment or by the presence of other foods or substances. The model presented here is an attempt to structure data in a suitable way so that it can be available for all user groups who need information on nutrient contents and modifications, recommendations, bibliographical references, etc. The goal is an ‘infological model’, based on a logical description of data from the point of view of the users. The concepts of ‘objects’, ‘properties’ and ‘relations’ so common in datamodelling, were used, and all the roles of Relational Algebra apply here. Software to manage tables according to these rules is available in the form of Relational Database Management systems.

An experiment, according to the model, covers one or more foods F_1, F_2… F_i… (in a certain stage s), each one containing nutrients N_1, N_2, N_j, affected by a treatment T, which is defined as a sequence of processes, P^1, P^2, P^j… where each stage s (process P^j) is defined by physical, chemical and biological parameters.

As a result of every stage (process P) of treatment T, acting on food (i) in status (s), the food is transformed becoming a new food:

$$F_i^s \quad F_i^{s+1}$$

and the nutrient contents may also be modified, so the nutrient loss or gain is the difference:

$$\Delta NV = NV_{F_i}^{Nj} s+1 - NV_{F_i}^{Nj} s$$

Extensions of the basic model and validation. Other objects and relations may also be defined and represented by tables. The model covers food groups, recommendations, references and literature searching, losses and gains in different conditions, bioavailability, dishes and recipes; it may be extended to cover additives and other non-nutrients. It was constructed and validated at the NFA by answering some 40 questions in the fields mentioned above. The language MIMER/QL was used in the project.

The PETRA system for measurement of dietary intake

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Conventional methods of assessing dietary intake are difficult. In the first place subjects have to weigh and keep accurate records of everything they eat. This is a problem when the subjects under review are unfamiliar with measuring equipment, and they may find accurate record keeping not just onerous, but impossible. It is time-consuming, and the tedious nature of the task may often lead to forgetfulness and incomplete records. In addition, subjects have to literate.

To overcome these problems, we have developed a new Portable Electronic Tape Recording Automated (PETRA) Scale. To use the scale subjects simply press a button and describe each item of food as it is served on to a plate. The description and a simultaneous record of the weight is recorded on a tape cassette. The system is simple and quick to use, extremely accurate (weights are recorded to the nearest lg), robust, and fully portable. The weight data is concealed from the subject and cannot be removed during the recording period.

To validate (Bingham & Cummings, 1984) the PETRA system 17 free-living healthy students and volunteers, aged 20–40 years used PETRA for 14 days and collected 24 hourly urine samples for nitrogen (N) determination. The completeness of the 24 hourly urine samples was verified by the PABA check test (Bingham and Cummings, 1983). The results were compared with records kept by 10 other healthy volunteers using conventional spring balances. Mean urine N was 78 ± 9% (range 60–92%) of dietary intake, which was not significantly different from that of 79 ± 8% (range 63–89%) with conventional weighed records. PETRA is available from Cherlyn Electronics, 22 High Street, Histon, Cambs., U.K.

Bingham, S. A., Cummings, J. H. (1983): The use of 4-amino benzoic acid as a marker to validate the completeness of 24th urine collections in man. *Clin. Sci.* **64,** 629–635.

Bingham, S. A., Cummings, J. H. (1984): Urine 24th nitrogen excretion as an independent measure of the habitual dietary protein intake in individuals. *Proc. Nut. Soc.* **43,** 80A.

Selenium content of a core group of foods based on a critical evaluation of published analytical data

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References published since 1960 which report analyses of selenium (Se) in foods were collected and evaluated according to five criteria: Number of Samples, Analytical Method, Sample Handling, Sampling Plan, and Analytical Quality Control. Data were grouped by food item and rated according to the criteria requirements which had been developed specifically for evaluating the quality of Se data. Ratings assigned to the data from each study yielded a Quality Index, indicating which data would be included in the calculation of the mean Se value for each food item. The Quality Indices for acceptable studies were summed to determine a Confidence Code intended to indicate the relative degree of confidence the user can have in each mean Se value. The selection of Se core foods was based on their ranked Se contribution to U.S. diets. Foods were ranked by multiplying Se contribution by the amount consumed by the 28 030 individuals who provided 3-day dietary intake data in the U.S. Department of Agriculture's 1977–78 Nationwide Food Consumption Survey. Mean, minimum, and maximum Se values, Confidence Codes, ranks, and references have been compiled for 111 food items. The five most highly ranked food aggregates (beef, white bread, eggs, pork, and chicken) provided half of the Se accounted for in the diets of the survey respondents.

Validation of the 7-day weighed diet record by comparison against total energy expenditure

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The recently developed double-labelled water (stable isotope) technique of measuring total energy expenditure has been used to validate the 7-day weighed diet record as a measure of energy requirements (Coward *et al.*, 1984).

The following were measured in ten normal-weight (mean ideal body weight [IBW] 99%) and eight obese (mean IBW 159%) women: (a) total energy expenditure (TEE) over 14 days (normal weight) or 28 days (obese) women; b) one (normal weight) or two (obese) 7-day weighed diet records (DIET); c) body weight and total body water (TBW) at both ends of the study period to assess changes in energy stores (body fat).

In five normal-weight subjects the agreement between DIET and TEE was within 10 per cent (see Table 1). In two subjects DIET overestimated TEE by 13 and 14% and in three subjects DIET underestimated TEE by 16, 22 and 28%. Allowing for changes in body composition did not improve the agreement; there are however many problems in assessing changes in body fat over such a short period of time. The discrepancy of 28% between DIET and TEE was in a subject who was mildly overweight (115% IBW) and a member of a slimming club. This tends to confirm suspicions that chronic 'dieters' will diet while keeping food records. With the limited data available so far, there is no indication in the remaining subjects of a constant bias in the weighed intake technique.

Table 1. *Normal-weight women.*

Subject	*Diet* (kcal)	*Tee* (kcal)	$\frac{Diet}{TEE}$	*Energy from stores (EFS)* (kcal)	*Diet + EFS* (kcal)	$\frac{Diet + EFS}{TEE}$
1	1807	1848	0.98	0	1807	0.98
2	2390	2461	0.97	0	2390	0.97
3	2024	1791	1.13	+ 61	2085	1.16
4	1842	1693	1.09	-215	1627	0.96
5	1673	1466	1.14	+133	1808	1.23
6	1421	1805	0.78	- 62	1352	0.75
7	1301	1807	0.72	NA	NA	NA
8	2516	3009	0.84	-167	2349	0.78
9	2311	2490	0.93	+ 171	2482	1.00
10	2608	2468	1.06	-295	2313	0.94
Mean	1989	2084	0.96	- 41	2024	0.97
± s.d.	±457	±488	±0.13		±394	±0.15

In obese subjects DIET only accounted for 67% of TEE (see Table 2). In seven out of eight subjects, energy was taken from fat stores, indicating that they were dieting while recording intake. However DIET + Energy from stores still only accounted for 84% of TEE indicating that subjects either are more on days when not recording intake and/or under-recorded actual food intake on recording days.

Table 2. *Obese women.*

Subject	$\frac{Diet}{TEE}$	*Energy from stores (EFS) (kcal)*	$\frac{Diet + EFS}{TEE}$
11	0.96	+402	1.16
12	0.40	+654	0.71
13	0.71	+240	0.79
14	0.64	-107	0.60
15	0.49	+854	0.85
16	0.79	+ 53	0.81
17	0.83	+568	1.06
18	0.52	+418	0.72
Mean	0.67	+385	0.84
± s.d.	±0.19		±0.19

Coward, W. A., Prentice, A. M., Murgatroyd, P. R., Davies, H. L., Cole, T. J., Sawyer, M., Goldberg, G. R., Haliday, D. and Macnamara, J. P. (1984): Euro/Nut Workshop, *Hum. Energy Metab.* Wageningen.