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Report on Nutrient Losses and Gains Factors used in European Food Composition Databases

Workpackage 1.5
Standards Development
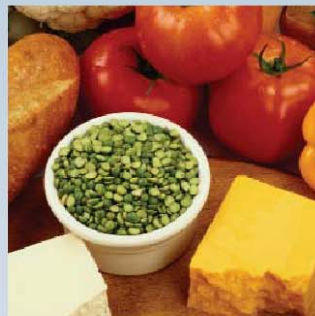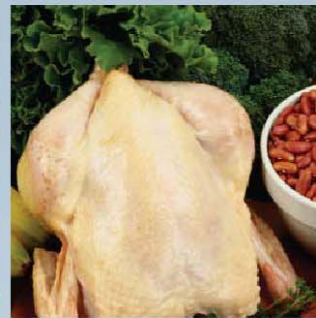
EUROPEAN FOOD INFORMATION RESOURCE NETWORK (EuroFIR)

Workpackage1.5 Standards Development

Report on Nutrient Losses and Gains Factors used in European Food Composition Databases
D 1.5.5 – NLG-Factors – Inventory

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Summary

Several efforts have been made at European level to include the energy and nutritional composition of cooked and prepared foods in food composition databases. This kind of data is needed to assess the nutritional status of the population, since a large amount of the food consumed is cooked or prepared. Some databases already comprise nutritional data acquired by the food manufacturing industry. The knowledge about nutrient losses and gains factors (NLG-factors) can also be used to calculate missing values of these data.

Analysing composite foods is expensive and time consuming. Nutritional values of these dishes are therefore calculated on the basis of data of individual ingredients. For this reason, NLG-factors, including nutrient retention and yield factors (fat/water) must be precisely known.

The revision of these factors, which are applied in recipe calculations, is presented in this report. The report also gives a short overview of the efforts made in the field of NLG-factors at European level in the past. Furthermore, the aspects of applying analysed or calculated data for the calculation of nutrient content in prepared foods are discussed and recommendations about how to handle with these data are presented.
The aim of this work is to be able to harmonize the data found in European food composition databases (FCDB) from partners involved in EuroFIR (European Food Information Resource), Network of Excellence.

Key words: Nutrient losses and gains factors, weight yield, nutrient retention, recipe calculation, analysed data, calculated data.

Contents

1. The Subtask 6 – Nutrient losses and gains factors

1.1 Background

The revision of nutrient losses and gains factors (NLG-factors), including nutrient retention and yield factors (fat/water), applied in recipe calculations, should be carried out to harmonize the data found in European food composition databases (FCDB) from partners involved in EuroFIR (European Food Information Resource), Network of Excellence.
Two main types of factors are needed: yield, weight yield or weight change factors and nutrient retention factors.[1] 'Nutrient losses and gains' cover the whole process of food preparation, covering both the nutrient retention and the yield factors.

The nutrient retention factor is the term used for the absolute amount of nutrient retained in the food after preparation in relation to the absolute amount of nutrient present in the food before preparation.

The yield factor is the term used for what is retained in weight of food or dish after preparation, processing or other treatment in relation to the absolute weight of the food before preparation. This may include changes in water or fat content.

An inventory of the currently used factors is the first step to gain some insight about them. Values should be compared and calculations standardized.

Several efforts have been made in the field of NLG-factors at European level. Within the scope of the FLAIR Eurofoods-Enfant Project, the work on nutrient losses and gains factors was supported. Bergström at the Nutrition Division of the National Food Administration, Sweden, has made a great effort in compiling, organizing and publishing the document "Nutrient Losses and Gains in the Preparation of Foods". The aim of the project was to collect data related to nutrient losses and gains in the preparation of foods with a view to recommend factors for use with the calculation of the nutrient content of foods and recipes[2].

The great work from Bognár (2002)[3] describes average retention of food constituents and weight yield by cooking of foods and dishes including NLG-factors tables and examples for conversion of recipe and for estimation of nutrient contents in dishes.
Detailed description of nutrient content calculation by different cooking methods was published by Bognár (1988)[4] and later by Bognár and Piekarski (2000)[5].

A further significant effort was made by Martins at the National Health Institute, Portugal.[6]
The aim of the project was the evaluation of the composition of Portuguese cooked dishes, due to limited analytical information available on it. The data obtained should be included in a food composition database.

The focus of this report has mainly been retention factors.

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[1] L. Bergström (1994), Rapport 32/94: Nutrient Losses and Gains in the Preparation of Foods.
[2] See 1.
[3] A. Bognár (2002). Tables on weight yield of food and retention factors of food constituents for the calculation of nutrient composition of cooked foods (dishes).
[4] A. Bognár (1988), Nutrient losses of foods during preparation at private household. AID – Consumer Service, special Edition, Bonn/Germany.
[5] A. Bognár, J. Piekaski (2000). Guidelines for Recipe Information and Calculation of Nutrient Composition of Prepared Foods (dishes).
[6] I. Martins (1998), Evaluation of the composition of Portuguese cooked foods.

1.2 Objective

The aim of this subtask is to collate the most current information available about the currently used yield and nutrient retention factors at European level, in order to be able to compare and harmonize them.

1.3 Method

In order to obtain quality data and adequately compare these factors, some background information about the calculation of these factors is required. Therefore, EuroFIR partners were asked to provide the applied NLG-factors with the corresponding documentation of the data origin (literature data, analysed data, etc).
All partners of Workpackage 1.5 and all food composition database compilers answered and contributed to the inventory.
The calculation methods, for which the factors are applied are being investigated in Workpackage 2.2 (Composite, Processed and Novel Foods). Since both issues are strongly connected to each other, results of the two work packages have been exchanged.

2. Current status of NLG-factors in food composition databases

Table 1: Current status of NLG-factors in food composition databases

	EuroFIR Partner Number	Institution	Institution	Use of Yield and nutrient retention Factors	Data available	Documentation available in English
1	01	IFR	Institute of Food Research	yes	yes	yes
2	02	GUT	Graz University of Technology	no	--	--
3	03	RUG	Ghent University, Belgium	no	no	--
4	06	NCI	National Centre of Hygiene, Bulgaria	no, only for vit. C	no	--
5	07	DFVF	Danish Institute for Food and Veterinary Research	yes	yes	no
6	08	KTL	National Public Health Institute, Finland	yes	yes	yes
7	10	AFSSA	Agence Française de Sécurité Sanitaire des Aliments	yes	yes	yes
8	11	ICETEC	Iðntæknistofnun / IceTec	yes	yes	yes
9	12	BfEL	Federal Research Centre for Nutrition and Food, Germany	yes	yes	yes
10	15	NKUA	National and Kapodistrian University of Athens	no	--	--
11	17	UCC	University College Cork	yes	yes	yes
12	18	BGU	Ben-Gurion University of the Negev, Israel	yes	yes	yes. USDA documentation
13	20	CSPO	Centro per lo Studio e la Prevenzione Oncologia, Italy	Only yield factors	yes (INRAN factors)	--
14	21	WUR	Wageningen University	yes	no	--
15	22	UiO	University of Oslo	yes	yes	yes
16	23	NFNI	National Food and Nutrition Institute, Poland	yes	yes	yes
17	24	NHI (INSA)	National Institute of Health (INSA), Portugal	yes	yes	yes
18	26	CESNID	Centre for Superior Studies on Nutrition & Dietetics, Spain	yes	yes	yes
19	28	FRI-SK	Food Research Institute, Slowak Republic	yes	yes	yes
20	29	NFA	Swedish National Food Administration	yes	yes	yes

Information has been collected from 20 countries of which 15 confirmed that they are using the factors. One country doesn't provide information in English.

2.1 Information collected in workpackage 2.2 (Composite, Processed and Novel Foods)

Table 2: Variation in the application of yield and nutrient retention factors in food composition databases

	Home-made dishes		Industrial composite foods	
	Yes	No	Yes	No
Do you have ingredient type information in the database?	14	3	7	9
Do you have quantities of ingredients in the database?	14	3	4	12
Do you produce nutrient values by recipe calculation?	14	3	11	5
Yield factors used:				
1. for water	12			
2. for water and fat	4			
Retention factors used:				
1. Water-soluble vitamins	2			
2. Water- and fat-soluble vitamins	10			

Report on 17 countries, which answered to the questionnaire. Nutrient retention factors were used for vitamins (for water-soluble in fourteen databases, for fat-soluble and water-soluble in ten food composition databases) and in six food composition databases for minerals and trace elements (Table 3).

Table 3: Country specific description for nutrient retention factors in composite foods

	Institution	Retention factors used in calculations	Describe your retention factors more specifically	Information collected for ingredients (of industrial composite foods)
1	AFSSA	For water-soluble vitamins	Dependent on nutrient type and treatment and food group	List of ingredients, Order of ingredients by weight
2	BfEL	For water-soluble vitamins, fat soluble vitamins, minerals, trace elements and macronutrients	General retention factor. Dependent on nutrient type, treatment and food group	Not relevant
3	CESNID	For water-soluble vitamins, For fat soluble vitamins, Minerals and trace elements	Other	Not collected
4	CSPO	Not relevant	Not relevant	Not relevant
5	DFVF	For water-soluble vitamins, For fat soluble vitamins, Minerals and trace elements, Other	Dependent on nutrient type and preparation type and food	List of ingredients, Order of ingredients by weight
6	FRI	For water-soluble vitamins, For fat soluble vitamins, Minerals and trace elements, Other	Dependent on nutrient type and treatment and food group	List of ingredients
7	ICETEC	For water-soluble vitamins, For fat soluble vitamins, Minerals and trace elements	Dependent on nutrient type and treatment and food	Not collected
8	IFR	For water-soluble vitamins, For fat soluble vitamins	Dependent on nutrient type and treatment and food	List of ingredients, Order of ingredients by weight
9	INRAN	Not relevant	Not relevant	List of ingredients
10	INSA	For water-soluble vitamins, For fat soluble vitamins, Minerals and trace elements, Other	Dependent on nutrient type and treatment and food group	Not collected
11	KTL	For water-soluble vitamins, For fat soluble vitamins	Dependent on nutrient type and treatment and food	List of ingredients, Order of ingredients by weight
12	NFA	For water-soluble vitamins	General retention factor (heat treatment in general)	Not collected
13	NKUA	No retention factors	No retention factors used	Not relevant
14	RUG/ NUBEL	No retention factors	No retention factors used	Not collected
15	UCC	For water-soluble vitamins, For fat soluble vitamins	Dependent on nutrient type and treatment and food group	Not collected
16	UiO	For water-soluble vitamins, For fat soluble vitamins, Other (Na)	Other (Dependent on nutrient and food group)	List of ingredients for a few, Not collected for most
17	WUR/ NEVO	Other (Retention factors for each mineral/vitamin can be applied)	Other (Not applied due to uncertainty about which factors to use)	Not collected

2.2 The applied systems

2.2.1 Current status

As presented in tables 1 and 2 retention factors are applied in 14 European food composition databases.

Among the countries, applying the retention factors in their food composition databases, not many differences in the systems were found. Furthermore, the used factors derive only from few well-known systems. For example Icetec also applies the factors used in the Danish food composition database. Therefore many countries are already using the same factors, which is an advantage towards data harmonisation.

The table below presents the different systems and the countries, which apply them in their food composition databases and consequently in their recipe calculation procedures.

Table 4: Systems applied in European food composition databases and their recipe calculations.

Institution	Bognár	McCance & Widdowson	USDA	Denmark	Bergström	Other/Own system
IFR		x				
GUT						
RUG/NUBEL						
NCI						X, vitamin C
DFVF				x		
KTL					x	
AFSSA	x					
ICETEC				x		
BfEL	x					
NKUA						
UCC		x				
BGU			x			
CSPO						X, for yield
WUR						x
UiO					x	
NFNI						x
NIH (INSA)	x					
CESNID		x				
FRI-SK	x					
NFA					x	
Total (n = 20)	4	3	1	2	3	4

BfEL, NIH (INSA) and FRI-SK apply the factors from Bognár. NIH (INSA) additionally uses the publications of Gall et al.[7] and Batista et al.[8] as reference for the retention factors. IFR and UCC apply the factors from McCance & Widdowson, 6th Edition, while CESNID applies the factors from the 5th edition. The factors used in the 6th edition were different to those used in earlier editions. The 6th edition applied retention factors to each ingredient in

[7] Gall et al (1983) » Gall, KL; Otwell, WS; Koburger, JA; Appledorth, M (1983) - Effects of four Cooking Methods on the Proximate Composition of Fish Fillets. Journal Food Science, 48, p. 1068-1074.
[8] Batista et al (1993) » Batista, I; Bandarra, NM; (1993) - Influence of four Cooking Methods on the Chemical Composition of different fish species. Portuguese Magazine of Nutrition. Vol. 5 (3), p. 5-14.

a recipe (excluding minor ingredients such as herbs, spices, salt) but earlier editions applied retention factors to the whole recipe based on the major ingredient.

CIQUAL, the food composition database from AFSSA does use retention factors in some recipe calculations. However, for simplicity reasons and to avoid introducing more errors, nutrient data on equivalent cooked ingredients (e.g. cooked potatoes, cooked ground meat) is sought for and is combined to estimate the composition of a cooked recipe (e.g. hachis parmentier). When this is not possible, then retention factors from Bognár are used. BGU applies the factors from USDA and DFVF and ICETEC apply the Danish factors.

NFA applies own factors, which were also published by Bergström[9]. KTL and UiO also apply the factors collected by Bergström. Additionally UiO uses a small number of the calculation factors for vitamin loss during cooking, which are derived from unpublished Norwegian tests.

NFNI applies own calculated factors, which are derived from studies regarding the effect of culinary treatment techniques on the nutritional value of fish, chicken and turkey dishes.[10] While some countries apply retention factors for different food groups (e.g. vegetables, cereals), nutrients and cooking methods (e.g. boiling, frying), other countries only use single factors. For example, NCI uses only correction factors for vitamin C in recipe calculations according to scientific literature.

WUR uses retention factors only on a very limited basis for the calculation of a few bakery recipes. Only the loss of water during the heating process (no vitamins or minerals) is calculated. There is the technical possibility to use loss or gain factors for each separate nutrient for all foods, but due to the uncertainty of which factor to use for a specific food, the work with these factors did not really start. Furthermore an inventory of the appropriate factors is being done. GUT, NKUA and RUG/NUBEL do not apply the retention factors.

2.2.2 Bognár

The currently used retention factors from BfEL, FIR-SK and NIH/INSA derive from the work of Bognár from 2002.[11] This study is one of several efforts to update and harmonise the food composition databases and to include the nutrient composition of cooked and prepared foods. Retention data of food constituents (nutrients) and own analytical results were checked by using common statistical methods to evaluate the relations between retention and the kind of food as a function of the cooking conditions.

Retention factors of food constituents by cooking of dishes consisting of several ingredients have been found to be about the same as by cooking of the single food typical of the dish. Retention factors by cooking of individual food items were, therefore, transferred to recipes (dishes) containing several ingredients. However, the cooking method can influence nutrient retention considerably. Therefore, retention factors typical for the cooking method are used. For boiling, steaming and frying, nutrient retention with or without con-

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[9] L. Bergström (1994), Rapport 32/94: Nutrient Losses and Gains in the Preparation of Foods.

[10] Beata Przygoda et al. (2003). The effect of culinary treatment techniques on the nutritional value of chicken and turkey dishes. National Food and Nutrition Institute, Warsaw, Poland.
Hanna Kunachowicz et al. (2003). The effect of culinary treatment techniques on the nutritional value of fish dishes. National Food and Nutrition Institute, Warsaw, Poland.

[11] Bognár, A. (2002). Tables on weight yield of food and retention factors of food constituents for the calculation of nutrient composition of cooked foods (dishes). Ed.: BFE, Karlsruhe.

sideration of the boiling medium and dripping juice may also be of importance. The data on the retention of food constituents during cooking of individual foods and dishes are incomplete. It seemed advisable, therefore, to create average nutrient retention factors for typical food categories. This was reasonable only, however, if the nutrient retention factors by cooking of single foods or dishes belonging to a category were about the same size. Because of the standardisation of the calculation method of nutrient composition of dishes, no variation of the retention factors of food constituents were given in the enclosed tables. Cooking of dishes, especially of breaded meat and fish, by using fat as the heating medium (e.g. frying in pan, deep frying) can lead to fat uptake in food. Quantities of fat uptake are, therefore, included in the tables. Factors for absorption of cooking salt during boiling and steaming of foodstuffs are also given.

The report includes formulae used for calculation and tables of average retention factors of food constituents after cooking of about 39 typical food (dish) categories. The actual retention factors for protein, fat, carbohydrates, sodium chloride, sodium, potassium, magnesium, calcium, phosphorus and iron are statistically approved values. For some other food constituents, in particular niacin, biotin, folate, pantothenic acid, vitamin E, K and B12, fatty acids, amino acids, cholesterol, the retention data available are incomplete and should be regarded as crude estimates. For any other food constituents, for which at present no data are available, a retention factor of 1.0 is preliminarily recommended.

Since cooking procedures of foods, as far as temperature and time are concerned, are more or less similar in all European countries, the retention factors in this study may be used as basic data to calculate the nutrient composition of dishes. This would also considerably improve the compatibility of the different nutrient databases for cooked foods and dishes. It is also of great importance that the data set for nutrient retention factors be further developed and extended to other countries.[12]

Further information about recipe calculation procedure in the German food composition database (BLS) is described in the proposal for the harmonisation of recipe calculation procedures, which was developed in Workpackage 2.2.

2.2.3 McCance & Widdowson

Vitamin loss estimation in foods and recipe calculations are described in the 6th edition of The Composition of Foods:[13]

The losses of heat and water labile vitamins in cooked recipe dishes were estimated by assigning a set of factors for percentage vitamin losses to each ingredient in the recipe, according to its food group and the method of cooking. Vitamin losses were not assigned to minor ingredients such as herbs, spices and salt. The percentage vitamin losses used for each food group and cooking method are shown in section 3 of the referred publication. This is a change from the approach used in previous editions, in which vitamin losses were applied to the whole recipe dish according to the major ingredient. Vitamin losses will vary according to the length, temperature and method of cooking, and the nature of the ingredients. For more accurate information the foods or composite dish should be analysed.

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[12] Bognár, A. (2002). Tables on weight yield of food and retention factors of food constituents for the calculation of nutrient composition of cooked foods (dishes). Ed.: BFE, Karlsruhe, (2002). Federal Research Centre for Nutrition, Institute of Chemistry and Biology.

[13] McCance & Widdowson (2002). The Composition of Foods, Sixth summary edition. Cambridge: Royal Society of Chemistry. Food Standards Agency, UK.

An example of the method of calculating the vitamin content in a cooked product taking into account the percentage vitamin loss is given below.

Vitamin content of cooked dish per 100g =

Vitamin content of uncooked dish/100g – $\dfrac{\text{vitamin content of uncooked dish x \% vitamin loss on cooking}}{100}$

For example, the thiamin content of brown bread, average, is 0.22mg per 100g and the percentage thiamin loss on toasting bread is 15%. Therefore the thiamin content of toasted brown bread calculated is

$$= 0.22 - \frac{(0.22 \times 15)}{100} = 0.19\text{mg/100g}$$

2.2.4 NIH (INSA)

For the calculation of the nutrient content (TN) per 100 g food in cooked foods the following equation was used:

$$\text{TN (in cooked food)} = \frac{\text{TN in raw food x retention factor}}{\text{Weight change*}} \times 100$$

$$\text{* Weight change (\%)} = \frac{\text{Weight of edible portion cooked food}}{\text{Weight of raw food}} \times 100 \ [14]$$

2.2.5 United States Department of Agriculture (USDA)

USDA Table of Nutrient Retention Factors, Release 5 (2003), implemented in Release 18 of the database: The resulting values quantify the nutrient content retained in a food after nutrient losses due to heating or other food preparations. The data set contains the factors for calculating retention of 25 components including vitamins, minerals and alcohol during food preparation.[15]

When nutrient data for prepared or cooked products were unavailable or incomplete in the database, nutrient values were calculated from comparable raw items or by recipe. When values are calculated in a recipe or from the raw item, appropriate nutrient retention (U.S. Department of Agriculture 2003) and yield factors (Matthews and Garrison, 1975) are applied.

To obtain the content of nutrient per 100 g of cooked food, the nutrient content per 100 g of raw food is multiplied by the nutrient retention factor and, when appropriate, adjustments are made for fat and moisture gains and losses.

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[14] Paul and Southgate (1978)
[15] U.S. Department of Agriculture, Agricultural Research Service. 2005. USDA National Nutrient Database for Standard Reference, Release 18. Nutrient Data Laboratory Home Page, http://www.nal.usda.gov/fnic/foodcomp or http://www.nal.usda.gov/fnic/foodcomp/Data/

Nutrient retention factors are based on data from USDA research contracts, recent research reported in the literature, and USDA publications. Most retention factors were calculated by the True Retention Method (%TR) (Murphy et al. 1975).

This method, as shown below, accounts for the loss of solids from foods that occurs during preparation and cooking.[16]

$$\%TR = (Nc*Gc) / (Nr*Gr) * 100$$

Where:

Nc = nutrient content per g of cooked food,
Gc = g of cooked food,
Nr = nutrient content per g of raw food, and
Gr = g of food before cooking.

2.3 Availability of retention factors for different nutrients

Table 5: Availability of retention factors for different nutrients

	Bognár	Denmark	McCance & Widdowson	USDA (Service Release 18)
Vitamin A	x	x	x	x
Vitamin E	x	x	x	
Vitamin C	x	x	x	x
Thiamin	x	x	x	x
Riboflavin	x	x	x	x
Niacin	x	x	x	x
Vitamin B6	x	x	x	x
Vitamin B12	x	x	x	x
Pantothenic acid	x		x	
Vitamin D	x	x	x	
Beta-Carotene	x		x	x
Folate	x	x	x	x
Sodium, Na	x	x		x
Potassium, K	x	x		x
Calcium, Ca	x	x		x
Magnesium, Mg	x	x		x
Phosphor, P	x	x		x
Iron, Fe	x		x	x
Protein	x			
Total (n = 19)	All	15	13	15

The availability of retention factors differs from system to system. For example in McCance & Widdowson, 6th Edition, retention factors are available only for vitamins. In other systems like Bognár, USDA and the Danish one, retention factors are also available for mineral substances, trace elements and macronutrients.

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[16] Composition of Foods. Raw, Processed, Prepared. USDA National Nutrient Database for Standard Reference, Release 18. 2005.

3. Overview of applied nutrient retention factors

Nutrient (or other food component) losses in cooking are normally reported as the percentage remaining and hence are commonly referred to as nutrient retention factors. They may result from the degradation or leaching of components but normally are treated only as loss of the component itself, not as contributing to the overall weight loss of the dish.[17] Nutrient retention factors were already collected and summarised in the past. Considering this, the table of nutrient retention ranges for vitamins prepared by Bergström[18] was used as a model, then updated and completed.

Information about retention factors for food composition databases in Denmark, Germany, Russia, Sweden, United Kingdom and United States was available in Bergströms work. Complementary information about France, Iceland, Poland, Portugal and Slovak Republic has been added. Apart from vitamins, factors for mineral substances, trace elements, fat, carbohydrates and protein were also available. The results are tabulated in tables 7 and 8.

As showed in table 5 the availability of retention factors for nutrients differs between the applied systems from the countries. Factors for protein, fat, carbohydrates, dietary fibre, minerals (ash)[19], sodium chloride[20] and amino acids are also available in the tables from Bognár. Data for protein from NFNI is also available.

The food groups and preparation or cooking methods in the tables 7 and 8 were selected with the aim of covering all food items and food groups, as well as representative and standard cooking methods. In some Food Composition Databases the use of retention factors is further differentiated according to the different cooking methods apart from boiling, frying and baking. Descriptions of further cooking methods are presented in appendix 1. The values are based on the food group of the ingredient in a recipe and not for individual ingredients (e.g. vegetables instead of carrot or cucumber).

Since the retention factors differ in the different systems, they are presented as retention ranges in the tables 7 and 8, e.g. vitamin A, vegetables, boiling: 85-95%.
Reasons for the differences are among other things the different cooking methods, cooking time and cooking temperature applied for the determination of the retention factors. See Fig.1.

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[17] I. D. Unwin (2000), EUROFOODS Guidelines for Recipe Information Management.
[18] L. Bergström (1994), Rapport 32/94: Nutrient Losses and Gains in the Preparation of Foods.
[19] Without cooking salt
[20] Related to the quantity of cooking salt added to the food or cooking water

Figure 1: Loss of vitamin C in relation to time and temperature during steaming of red cabbage [21]:
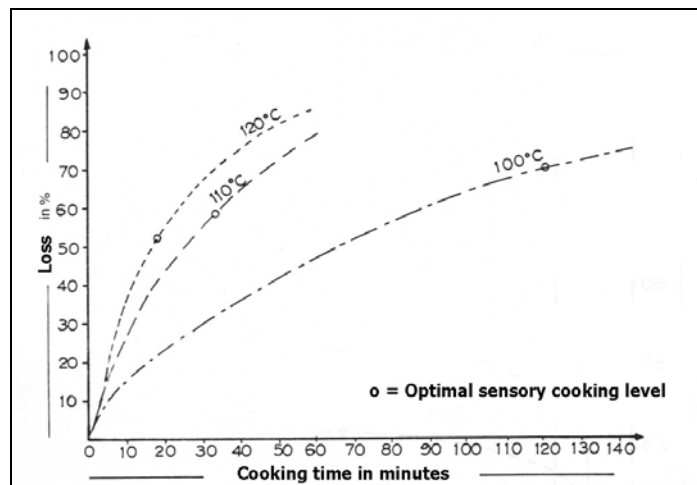
Further aspects, which can influence nutrient changes in the foods, are e.g. food quality (part of plant or animal, physical state), effect of oxygen and light, cooking utensils, lid or foil covering food during cooking and final internal temperature, e.g. in cooked meat.

A precondition for data harmonisation would be to standardise these cooking aspects in order to reach the same or at least similar retention factors, and to be able to compare them. This would be necessary in the case of new or further analysis of the food.
On the other hand, the adoption of already available accurate yield and nutrient retention factors is also a possibility, considering that the analysis of retention data of food nutrients is time-consuming and costly.

Furthermore, there is another difference by the determination of the nutrient retention factors. The Bognár system, for example, considers additionally the **yield factor** in the formula.

Figure 2 [22]**:**

$$\text{Retention factor of nutrient } j \text{ in dish } k \text{ prepared by method } p \ (a_{(j,\,k,\,p)})$$

$$a_{(j,k,p)} = \frac{Z_{(j,k,p)}}{X_{(j,k,p)}} \times e_{(k,p)}$$

Where:
- $a(j, k, p)$ retention factor of nutrient j in dish k prepared by method p
- $Z(j, k, p)$ content of nutrient *j* in 100 g edible part of dish *k* prepared by method *p* in gram, milligram or microgram (analysed)
- $X(j, k, p)$ content of nutrient *j* in 100 g edible part of ingredients for preparation of dish *k* in gram, milligram or microgram (analysed)
- $e(k, p)$ weight yield factor of dish *k*, edible part, prepared by method *p* (see formulae 2 in paragraph 1)

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[21] A. Bognár (1988), Nutrient losses of foods during preparation at private household. AID – Consumer Service, special Edition.
[22] A. Bognár (2002), Tables on weight yield of food and retention factors of food constituents for the calculation of nutrient composition of cooked foods (dishes).

When for example meat is fried, a water loss and consequently a weight loss occur. Since by losing water, the concentration of a nutrient in the meat rises, it means that the content of a nutrient after frying is higher than before. For this reason the yield factor should be considered in the determination of nutrient retention factors by cooking of dishes.

Experimental results have shown that discrepancies between chemical analyses and computerized programs for the calculation of nutrients content in prepared foods are generally not significant. A study from 2003 of traditional Greek recipes showed that the results of the computed macronutrients and energy of foods and recipes, compared to the chemically determined macronutrients and energy, had a satisfactory degree of agreement. [23]
Further studies showed that a maximum of correspondence is achieved when calculations are based on the following data:
- Data of nutrient content per 100 g edible portion of raw ingredients
- Quantity of ingredients for preparation of 100 g edible portion of cooked food (dish) in the ready-to-serve condition
- Retention factors of food constituents during cooking.[24]

Table 6: Nutrient composition of selected dishes – comparison between analytical and calculated results[25]:

		Content per 100 g dish, edible portion[1]									
Dish/method		Water (g)	Protein (g)	Fat (g)	Carbohydrate (g)	Dietary fibre (g)	Ash (total)[2] (g)	Salt (NaCl) (g)	Potassium (mg)	Vitamin B$_1$ (µg)	Vitamin B$_6$ (µg)
Rice, boiled	A	73.2	2.1	0.2	23.2	0.9	0.39	0.25	10	13	16
	C	73.6	2.1	0.2	22.9	0.8	0.41	0.29	18	10	29
Difference	%	+ 1	0	0	− 1	− 11	+ 5	+ 16	+ 80	− 23	+ 80
Broccoli,	A	83.4	3.5	4.8	3.2	3.6	1.48	0.44	292	90	83[3]
Stewed	C	84.8	3.0	4.6	2.8	2.7	1.44	0.44	337	76	82[3]
Difference	%	+ 2	− 14	− 4	− 13	− 24	− 3	0	+ 15	− 16	− 1
Chicken,	A	58.8	25.5	14.1	0.1	0	1.51	0.29	290	78	343
Grilled	C	59.9	25.3	13.4	0.1	0	1.40	0.27	302	77	382
Difference	%	− 2	− 1	− 5	0	0	− 7	− 7	+ 4	+ 1	+ 11
Pork,	A	68.6	17.3	12.8	0.1	0	1.19	0.38	240	465	233
Braised	C	67.9	16.1	14.7	0.1	0	1.23	0.38	245	494	298
Difference	%	− 1	− 7	+ 15	0	0	+ 3	0	+ 2	+ 6	+ 28

Note: A = Analysed results, mean value (Bognar 1990, 1999), C = Calculated (basic data see Tables 7–10).
[1]Analysed content = 100%.
[2]Including sodium chloride.
[3]Vitamin C in milligram.

In conclusion both analysed and calculated data can be applied for the recipe calculation in food composition databases; however, analysed data should be favoured.

Information about the nutrient content of foods is needed for the use of recipe calculation in food composition databases. When this information is not available for a specific food item, it is recommended to use the nutrient content values from a food item with similar nutritional composition. An estimated value is better than no value.

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[23] E. Vasilopoulou et al. (2003). Journal of Food Composition and Analysis.
[24] A. Bognár (2002). Tables on weight yield of food and retention factors of food constituents for the calculation of nutrient composition of cooked foods (dishes).
[25] Bognár, A., Piekaski, J. (2000). Guidelines for Recipe Information and Calculation of Nutrient Composition of Prepared Foods (dishes). Journal of Food Composition and Analysis.

For any other food constituents, for which at present no data are available, a retention factor of 1.0 is preliminarily recommended.[26]

Whatever approach is chosen, accurate documentation about analysis and calculation methods is essential.

After building the new tables 7 and 8 with the data from the different countries, the current data was compared with the table prepared by Bergström. Some variations were established between the factors in tables 7 and 8 and in Bergström ones. However the factors do not vary strongly from each other. Few major variations were noted e.g. for vitamin A by boiling meat and poultry. In this case the nutrient retention factors presented by Bergström were higher and the range was smaller than the factors presented in tables 7 and 8.

The nutrient retention factors presented in tables 7 and 8 in this document represent the currently applied factors in European food composition databases from EuroFIR partners. These factors should be classified as a discussion basis for a future harmonisation of the data in recipe calculation procedures at European level. A suggestion for further approaches can be found in section 5 of this document.

Detailed information about the used nutrient retention factors in European food composition databases is given in appendix 3 of this document.

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[26] A. Bognár (2002). Tables on weight yield of food and retention factors of food constituents for the calculation of nutrient composition of cooked foods (dishes).

Table 8: Retention ranges by vitamins in %, on recipe level.
The nutrient retention factors are based on data from the countries that make use of these factors (see section 2.2.1)

Food Group	Preparation or cooking methods	Vita-min A	Vita-min E	Vita-min C	Thiamin	Ribo-flavin	Niacin	Vitamin B6	Vita-min B12	Pan-tothenic acid	Vita-min D	Beta-Carote-ne
Bread, grains, flour, pasta, rice	Boiling	80-95	80-100	50-100	50-85	50-90	60-100	50-90	75-100	60-95	90-100	80-95
	Frying	90	100	50-100	70-90	75-100	85-100	60-90	100	80	100	90
	Oven baking/ Baking	90-95	100	50-100	70-85	75-100	85-95	75-90	100	75	100	90-95
Vegetables	Boiling	80-95	80-100	45-90	60-90	60-95	70-95	60-95	60-100	60-90	90-100	80-100
	Frying	85-90	100	50-85	70-90	75-95	70-100	60-95	70-100	90	100	85-90
	Oven baking/ Baking	90-95	100	50-85	70-90	70-95	70-95	60-95	70-100	85-95	100	80-100
Vegetables with leaf and steam	Boiling	80-90	80-100	30-65	50-80	60-90	60-95	60-90	60-100	70-90	90-100	80-90
	Frying	90	100	30-85	70-90	60-100	60-85	60-95	100			
	Oven baking/ Baking	90	100	30-70	60-90	60-95	60-95	60-95	70-100	90		80-90
Potatoes	Boiling	80-100	80-100	25-85	70-80	70-95	60-95	60-95	70-100	70-90	90-100	80-100
	Frying	90-100	100	50-80	70-80	70-95	70-95	60-95	80-100	90	100	90-100
	Oven baking/ Baking	90-100	100	50-80	70-85	70-95	70-95	60-95	80-100	90	100	90-100
Fruits and berries	Boiling	75-90	80-100	25-75	65-80	65-90	65-90	60-90	90-100	75-90	90	75-10
	Frying	90	100	50-100	70-100	65-100	65-100	60-100	100	100		90
	Oven baking/ Baking	90	100	50-100	70-100	65-100	65-100	60-100	100	100		90
Milk and milk products	Boiling	80-100	80-100	50-85	70-100	75-100	85-100	80-90	55-95	90	90-100	80-100
	Frying	90-100	80	50-65	70-100	75-100	85-100	75-90	55-95			100
	Oven baking/ Baking	90-100	80-100	50-70	70-100	75-100	85-100	75-90	55-95	75	100	90-100
Meat, Poultry	Boiling	55-90	75-100	50-85	30-80	70-95	5-900	35-80	50-90	40-90	75-90	55-90
	Frying	55-85	55-100	50-85	50-80	45-90	70-100	45-80	65-95	75-90	55-90	55-100
	Oven baking/ Baking	75-100	55-100	50-85	45-80	45-95	55-90	45-80	60-95	70-90	55-100	55-100
Fish, Shellfish	Boiling	70-90	70-100	50-100	60-90	70-100	70-95	70-100	80-95	70-90	70-90	70-90
	Frying	80-100	80-100	50-85	70-85	55-100	80-100	75-90	75-100	80-95	80-100	80-90
	Oven baking/ Baking	80-100	80-100	50-85	70-95	55-100	80-100	80-90	85-90	80-85	80-100	80-90
Eggs	Boiling	90-100	100	50-100	70-90	75-95	70-100	80-95	80-100	80	95	90-100
	Frying	80-100	90-100	50-100	70-95	70-95	85-100	80-95	85-100	80-85	90-100	90-100
	Oven baking/ Baking	80-100	90-100	50-100	70-95	70-95	85-100	75-95	80-100	75-80	90-100	90-100
Margarine, butter, oil	Boiling	85	75	50-100	70-100	75-100	85-100	80-100	100			
	Frying	50-90	20-95	50-100	70-100	75-100	85-100	80-100	100			
	Oven baking/ Baking	85-90	75-95	50-100	70-100	75-100	85-100	80-100	100			

Table 7: Retention ranges by protein, trace elements and mineral substances in %, on recipe level.
The nutrient retention factors are based on data from the countries that make use of these factors (see section 2.2.1)

Food Group	Preparation or cooking methods	Folate	Sodium, Na	Potassium, K	Calcium, Ca	Magnsium, Mg	Phosphor, P	Iron, Fe	Protein
Bread, grains, flour, pasta, rice	Boiling	50-80	50-100	55-95	90-100	85-100	90-95	75-95	95
	Frying	70	100	100	100	100	100	100	100
	Oven baking/ Baking	50-70	100	100	100	100	100	100	100
Vegetables	Boiling	45-95	45-100	45-100	90-100	60-100	90-100	75-100	90-100
	Frying	45-85	100	100	100	100	100	100	95-100
	Oven baking/ Baking	50-85	100	100	100	100	100	100	95-100
Vegetables with leaf and steam	Boiling	45-95	75-95	50-100	90-100	90-95	90-100	75-100	90-100
	Frying		100	100	100	100	100	100	
	Oven baking/ Baking	50-70	60-100	100	100	100	100	100	
Potatoes	Boiling	50-90	60-95	80-100	90-100	90-100	90-100	90-100	95
	Frying	50-75	100	100	100	100	100	100	100
	Oven baking/ Baking	50-75	100	100	100	100	100	100	100
Fruits and berries	Boiling	20-70	60-100	60-100	90-100	80-100	80-100	90-100	95
	Frying	100	100	100	100	100	100	100	100
	Oven baking/ Baking	100	100	100	100	100	100	100	100
Milk and milk prod-ucts	Boiling	50-90	90-100	90-100	90-100	90-100	90-100	90-100	100
	Frying	80	100	100	100	100	100	100	100
	Oven baking/ Baking	50-85	100	100	100	100	100	100	95
Meat	Boiling	50-95	40-95	50-100	80-100	60-100	60-100	80-100	90-100
	Frying	50-95	50-100	60-100	90-100	85-100	85-100	90-100	95-100
	Oven baking/ Baking	50-95	50-100	55-100	80-100	65-100	65-100	95-100	95-100
Fish	Boiling	50-85	15-100	75-100	90-100	85-100	85-100	80-100	75-100
	Frying	5-100	15-100	85-100	90-100	90-100	90-100	85-100	95-100
	Oven baking/ Baking	50-90	15-100	85-100	100	90-100	90-100	85-100	95-100
Eggs	Boiling	75-80	95-100	95-100	95-100	95-100	95-100	100	100
	Frying	70-80	100	100	100	100	100	100	100
	Oven baking/ Baking	50-80	100	100	100	100	100	100	100
Margarine, butter, oil	Boiling		95	95	95	95	95-100		
	Frying		100	100	100	100	100		
	Oven baking/ Baking		100	100	100	100	100		

4. Yield factors (weight losses and gains)

The partner institutions IFR, BfEL, UCC, BGU, CSPO, WUR, UiO, NFNI, NIH/INSA, FRI-SK and NFA apply yield factors (weight loss and gain) for recipe calculation procedures in their food composition databases. In the majority of the cases the partners use yield factors from the same source applied for the nutrient retention factors.

Similar to the field of nutrient retention factors, a lot of work was already done by Bergström[27] summarising data from different countries and their food composition databases in the field of yield factors. Since this is a more complicated issue, it will be discussed at a later date. However, the yield factor by cooking is an important aspect for the determination of nutrient retention factors, as shown in section 3 of this document.
As opposed to nutrient retention factors, the yield factors are determined for specific dishes (e.g. apple pie or butter cake) and not for composed food groups like vegetables, milk and milk products.

A brief overview about the available data for yield factors used in the European food composition databases is given in the appendix 4 of this document.

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[27] L. Bergström (1994), Rapport 32/94: Nutrient Losses and Gains in the Preparation of Foods.

5. Discussion and plans for the future

Information about energy and nutrient composition of dishes and other prepared foods are necessary for the assessment of nutrition surveys, in order to evaluate the population nutritional intake. Furthermore, efforts are being made with the aim to make nutritional data accessible for everyone in the world.

The most precise method for producing nutrient values of composite foods is to analyse them directly.[28] However, the chemical analysis of cooked foods is costly and time consuming.

Experimental results have shown that discrepancies between chemical analyses and computerized programs for the calculation of nutrients content in prepared foods are generally not significant. Nevertheless, some nutrient retention factors, such as vitamin B_6 need to be reviewed to avoid generating mistakes in the food composition databases. Further studies showed that a maximum of correspondence is achieved when calculations are based on the following data:
- Data of nutrient content per 100 g edible portion of raw ingredients
- Quantity of ingredients for preparation of 100 g edible portion of cooked food (dish) in the ready-to-serve condition
- Retention factors of food constituents during cooking.[29]

In conclusion both analysed and calculated data can be applied for the recipe calculation in food composition databases, however, analysed data should be favoured.
Whatever approach is chosen, accurate documentation about analysis and calculation methods is essential.

Regarding the aims of EuroFIR the applied yield and nutrient retention factors from different partners are showed in this inventory, were no strong differences were observed. Only few different systems are used, therefore, appropriate conditions are given in direction data harmonisation.

Plans for the future

The yield and nutrient retention factors presented in this document should be classified as the basis for a future harmonisation of the data in recipe calculation procedures at European level. Following this overview inventory, a proposal for EuroFIR partners and further users including recommended yield and nutrient retention factors according to cooking methods and food groups will be published soon.

The subtask elaboration is being conducted in collaboration with Workpackage 2.2 (Composite, Processed and Novel Foods). Thus, the results of subtask 6 in Workpackage 1.5 (this document) and the results of Workpackage 2.2 in the field of recipe calculation procedures will be merged into a further document giving an overview of both topics.

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[28] H. Greenfield, D.A.T. Southgate (2003), Food Composition Data. FAO, Rome.
[29] A. Bognár (2002). Tables on weight yield of food and retention factors of food constituents for the calculation of nutrient composition of cooked foods (dishes).

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1   Bergström, L. (1994). Rapport 32/94: Nutrient Losses and Gains in the Preparation of Foods. National Food Administration, Sweden, p. 18; p. 37-41.

2   Bognár, A. (1988). Nutrient losses of foods during preparation at private household. AID – Consumer Service, special Edition, Bonn/Germany, p. 22, picture 8.

3   Bognár, A. (2002). Tables on weight yield of food and retention factors of food constituents for the calculation of nutrient composition of cooked foods (dishes). BFE, Karlsruhe, Germany, p. 7-11; p. 41-43; p. 95-97.

4   Bognár, A., Piekarski, J. (2000). Guidelines for Recipe Information and Calculation of Nutrient Composition of Prepared Foods (dishes). Journal of Food Composition and Analysis, p. 405.

5   Clausen, J., Ovesen, L. (2001). Proximate Contents, Losses and Gains of Fat, Protein and Water comparing Raw, Hospital- and Household-Cooked Pork Cuts. Journal of Food Composition and Analysis, 14, p. 491-503.

6   Comments about recipe calculation procedures provided by Porto, A. A. and Oliveira, L., NHI (INSA) (2005).

7   Comments about the Swedish Food Composition Table provided by Becker, W., NFA (2005).

8   Composition of Foods (2005). Raw, Processed, Prepared. USDA National Nutrient Database for Standard Reference, Release 18. U.S. Department of Agriculture, Beltsville Human Nutrition Research Center, p. 7.

9   Greenfield, H., Southgate, D.A.T. (2003). Food Composition Data. Food and Agriculture Organization of the United Nations, Rome.

10 Kunachowicz, H., Przygoda, B., Szulc, M., Wojtasik, A., Balas, J. (2003). The effect of culinary treatment techniques on the nutritional value of fish dishes. National Food and Nutrition Institute, Warsaw, Poland. Abstract form for the 9th European Nutrition Conference in Rome.

11 Matthews, R.H., and Garrison, Y.J. (1975). Food yields summarized by different stages of preparation. U.S. Department of Agriculture, Agriculture Handbook 102.

12 Martins, I. (1998). Evaluation of the composition of Portuguese cooked foods (Resumé of the dissertation in Portuguese).

13 McCance & Widdowson's (2002). The Composition of Foods, Sixth summary edition. Cambridge: Royal Society of Chemistry. Food Standards Agency, UK, p. 437.

14 NEVO – Dutch Nutrient Database, Netherlands Nutrition Centre, (2006) : http ://www.nevo-foodcomp.nl/index_en.htm/

15 Przygoda, B., Kunachowicz, H., Iwanow, K., Balas, J., (2003). The effect of culinary treatment techniques on the nutritional value of chicken and turkey dishes. National Food and Nutrition Institute, Warsaw, Poland. Research Project No. 3P06T 069 22.

16 Unwin, I. D. (2000). EUROFOODS Guidelines for Recipe Information Management. Journal of Food Composition and Analysis, 13, p. 751.

17 U.S. Department of Agriculture, Agricultural Research Service (2005). USDA National Nutrient Database for Standard Reference, Release 18. Nutrient Data Laboratory Home Page, http://www.nal.usda.gov/fnic/foodcomp or http://www.nal.usda.gov/fnic/foodcomp/Data/

18 Vasilopoulou, E., Georga, K., Grilli, E., Linardou, A., Vithoulka, M., Trichopoulou, A. (2003). Compatibility of computed and chemically determined macronutrients and energy content of traditional Greek recipes. Journal of Food Composition and Analysis. Athens, Greece, 16, p.717.

Appendix 1. Examples for cooking methods (Bognár 2002):

1. Cooking by moist heat
Heat transfer from energy source to food surface with water or steam by convection.

- boil, to
Cooking of food in the presence of high quantity of water or containing liquid in a pot.
Temperature of cooking liquid and of food: ~ 100°C; pressure: ~ 0.1 MPa.

- pressure boil, to
Cooking of food in the presence of high quantity of water or containing liquid in pressure cooker.
Temperature of cooking liquid and of food: ~ 102 -120°C; Pressure: ~ 0.11-0.20 MPa.

- microwave boil, to
Cooking of food in the presence of high quantity of water or containing liquid in a pot by using microwave oven.
Temperature of cooking liquid and of food: ~ 100°C; Pressure: ~ 0.1 MPa.

-steam, to
Cooking of food in vapour from boiling water in an atmospheric steamer pot.
Temperature of steam and of food: ~ 100°C; Pressure: ~ 0.1 MPa.

- pressure steam, to
Cooking of food in vapour from boiling water in a pressure steamer.
Temperature of steam and of food: ~ 102 -120°C; Pressure: ~ 0.11-0.20 MPa.

- stew, to
Cooking of food in presence of small quantity of water or containing liquid in a pot or pan.
Temperature of cooking liquid and of food: ~ 100°C; Pressure: ~ 0.1 MPa.

- pressure stew, to
Cooking of food in presence of small quantity of water or containing liquid in a pressure cooker.
Temperature of cooking liquid and of food: ~ 102 -120°C; Pressure: ~ 0.11-0.20 MPa.

- microwave stew, to
Cooking of food in the presence of small quantity of water or containing liquid in a pot by using microwave oven.
Temperature of cooking liquid and of food: ~ 100°C; Pressure: ~ 0.1 MPa.

2. Cooking by dry heat
Heat transfer from energy source to food surface with air, fat, radiation (e.g. infra red) and conduction (e.g. contact grill). Temperatures of cooking medium (fat) or area or metal surface resp. are between 140 °C and 350 °C. The surface of food is usually browned.

- fry in pan, to (sauté)
Cooking of food in a pan with a small quantity of added fat. The food surface will mostly brown.
Temperature of fat or oil: 160 °C to 200 °C
Temperature of food core: <100°C

Cooking time: 2-8 min for eggs
4-20 min for meat and fish
3-15 min for vegetables and other foods

- fry in oven, to
Cooking of meat in oven with and without added fat; by hot air. The food surface will most-ly brown.
Temperature of air in oven: 160 °C to 250 °C
Temperature of food core: <100°C
Cooking time: 30-240 min for meat and meat products

- bake in oven, to
Baking in oven will usually applied to cook starch reach foods and dishes such as bread, cake, pizza, vegetables, fruits and potatoes.
Temperature of air in oven: 160 °C to 250 °C
Temperature of food core: <100°C
Cooking time: 10-60 min for vegetables, fruits
20-70 min for bread, cake, pizza, potato

- deep fry, to
Cooking of food in fat or oil, deep enough to immerse the food entirely. The food surface will mostly brown.
Temperature of fat or oil: 140 °C to 200 °C
Temperature of food core: <100°C
Cooking time: 4-20 min for meat and fish
3-15 min for vegetables, potatoes and other foodstuffs

- grill, to ; broil, to ; barbecue, to
Cooking of food by direct radiant heat over or under a heat source (e.g. infra red grill, charcoal).The food surface will mostly brown.
Temperature of hot air: 200 °C to 350 °C
Temperature of food core: <100°C
Cooking time: 4-20 min for meat and fish
30-70 min for poultry (whole)
2-15 min for vegetables, potatoes and other foods

- contact fry, to (griddle)
Cooking of food on a heated heavy metal plate or between two heated heavy metal plates (e.g. contact grill). The food surface will mostly brown.
Temperature of plates: 180 °C to 250 °C
Temperature of food core: <100°C
Cooking time: 4-20 min for meat and fish
2-15 min for vegetables and potatoes

Appendix 2: List of partners, who contributed to this inventory in Workpackage 1.5:

Partner ID	Institution	Institution	Database	Country
01	IFR	Institute of Food Research	The Composition of Foods	UK
02	GUT	Graz University of Technology		Austria
03	RUG	Ghent University	Nutriments Belgique (NUBEL)	Belgium
06	NCI	National Centre of Hygiene	Food Composition Database	Bulgaria
07	DFVF	Danish Institute for Food and Veterinary Research	Danish Food Composition Database	Denmark
08	KTL	National Public Health Institute	FINELI	Finland
10	AFSSA	Agence Française de Sécurité Sanitaire des Aliments	CIQUAL	France
11	ICETEC	Iðntæknistofnun / IceTec	Icelandic Food Composition Tables	Iceland
12	BfEL	Federal Research Centre for Nutrition and Food	BLS	Germany
15	NKUA	National and Kapodistrian University of Athens	Composition Tables of Foods and Greek dishes	Greece
17	UCC	University College Cork	Irish Food Nutrient Database	Ireland
18	BGU	Ben-Gurion University of the Negev	BGU	Israel
20	CSPO	Centro per lo Studio e la Prevenzione Oncologia	INRAN	Italy
21	WUR	Wageningen University	Nederlands Voedingsstoffenbestand (NEVO)	The Netherlands
22	UiO	University of Oslo	Food Composition Tables	Norway
23	NFNI	National Food and Nutrition Institute	Food Composition Tables	Poland
24	NHI-INSA	National Institute of Health (INSA)	Food Composition Tables	Portugal
26	CESNID	Centre for Superior Studies on Nutrition & Dietetics		Spain
28	FRI-SK	Food Research Institute	Slovak Food Data Bank	Slovak Republic
29	NFA	Swedish National Food Administration	Food Composition Database	Sweden

Appendix 3: Percentage of nutrient retention (nutrient retention factors)

The applied systems of European Food Composition Databases:
- Bognár: BfEL, NIH/INSA, FRI-SK, AFSSA
- McCance & Widdowson: IFR, UCC, CESNID
- USDA: BGU
- Danish Data: DFVF, ICETEC
- Bergström: KTL, UiO, NFA
- Other/Own system: NCI, CSPO, NFNI

Protein	Bognar	McCance	USDA	Poland
Cooked/Boiled				
Bread, grains, flour, pasta, rice	0	-	-	10
Vegetables	0-10	-	-	10
Vegetables with leaf and steam	0-10	-	-	10
Potatoes	0-5	-	-	10
Fruits and berries	5	-	-	10
Milk and milk products	0	-	-	10
Meat	0-10	-	-	10
Pork	2-10	-	-	-
Veal and beef	2-10	-	-	-
Poultry	0-10	-	-	-
Fish	0-25	-	-	10
Low fat fish	0-25	-	-	-
Fat fish	0-25	-	-	-
Eggs	0	-	-	-
Margarine, butter, oil	-	-	-	-
Fried				
Bread, grains, flour, pasta, rice	0	-	-	-
Vegetables	0-5	-	-	-
Vegetables with leaf and steam	-	-	-	-
Potatoes	0	-	-	-
Fruits and berries	0	-	-	-
Milk and milk products	5*	-	-	-
Meat	0-5	-	-	10
Pork, breaded	2	-	-	-
Veal and beef, breaded	2	-	-	-
Poultry	0-3	-	-	-
Fish	0-5	-	-	0
Low fat fish	0-5	-	-	-
Low fat fish, breaded	0	-	-	-
Fat fish	0-5	-	-	-
Fat fish, breaded	0	-	-	-
Eggs	0-5	-	-	-
Margarine, butter, oil	-	-	-	-

Protein	Bognar	McCance	USDA	Poland
Oven baked/Baked/in Dishes				
Bread, grains, flour, pasta, rice	0	-	-	-
Vegetables	0	-	-	-
Vegetables with leaf and steam	0	-	-	-
Potatoes	0	-	-	-
Fruits and berries	0	-	-	-
Milk and milk products	5	-	-	-
Meat	0-5	-	-	-
Fish	0-5	-	-	-
Eggs	0	-	-	-
Margarine, butter, oil	-	-	-	-

Retinol	Denmark *	Norway	Bognar	McCance	USDA	Poland	Bergström
Cooked/Boiled							
Bread, grains, flour, pasta, rice	10	-	5-10	-	5-10	20	10
Flour/ Meal	-	-	5-10	-	10	-	10
Pasta	-	-	5-10	-	5	-	10
Rice, white/ brown	-	-	5-10	-	5	-	10
Vegetables	10	-	-	-	10	20	10
Vegetables with leaf and steam	10	-	-	-	-	20	10
Potatoes	10	-	-	-	0	20	10
Fruits and berries	10	-	25	-	-	20	10
Milk and milk products	10	10	0	-	0	20	10
Meat	10	15	15-45	0	-	20	15
Pork	-	-	15-20	-	-	-	15
Beef	-	-	15-20	-	25	-	15
Poultry	(10)	-	20-45	-	-	-	15
Fish	10	10	10-30	-	15-20	20	10
Low fat fish	-	-	10	-	20	-	10
Fat fish	-	-	30-10	-	15	-	10
Eggs	5	10	0	-	0	-	10
Margarine, butter, oil	15	-	-	-	-	-	10
Fried							
Bread, grains, flour, pasta, rice	10	-	10	-	5	-	10
Flour/ Meal	-	-	10**	-	5	-	10
Vegetables	10	-	-	-	15	-	10
Vegetables with leaf and steam	10	-	-	-	-	-	10
Potatoes	10	-	-	-	0	-	10
Fruits and berries	10	-	10	-	-	-	10
Milk and milk products	10	-	0	-	0	-	15
Meat	20	15	15-45	0	25	20	15
Pork	-	-	20	-	-	-	15
Beef	-	-	15-45	-	25	-	15
Poultry	-	-	20-60	-	-	-	15
Fish	20	10	15-20	0	15	20	10
Low fat fish	-	-	10	-	15	-	10
Fat fish	-	-	15-20	-	15	-	10
Eggs	20	10	0-10	-	0	-	10
Margarine, butter, oil	50	10	-	-	-	-	10
Oven baked/Baked/in Dishes							
Bread, grains, flour, pasta, rice	10	-	10	-	5-10	-	10
Flour/ meal	-	-	10***	-	10	-	10
Pasta	-	-	-	-	5	-	10
Vegetables	(10)	-	-	-	5	-	10
Vegetables with leaf and steam	(10)	-	-	-	-	-	10
Potatoes	(10)	-	-	-	0	-	10
Fruits and berries	10	-	10	-	-	-	10

Retinol	Denmark *	Norway	Bognar	McCance	USDA	Poland	Bergström
Milk and milk products	10	10	0	-	0	-	10
Meat	5	15	0-25	0	20-25	-	10
Pork	-	-	20	-	-	-	15
Beef	-	-	-	-	25	-	15
Poultry	(10)	-	-	-	-	-	15
Fish	(20)	10	15-20	0	10-15	-	10
Low fat fish	-	-	10	-	10	-	10
Fat fish	-	-	15-20	-	15	-	10
Eggs	(20)	10	0-10	-	0	-	10
Margarine, butter, oil	(15)	10	-	-	-	-	10

* Vitamin A
** Bognar: 'Flour/ Meal fried' = pancake
***Bognar: 'Flour/ Meal baked' = pizza, cake, bread

Beta-Carotene	Norway	Bognar*	McCance	USDA	Poland	Bergström
Cooked/Boiled						
Bread, grains, flour, pasta, rice	-	5-10	-	5-10	20	10
Flour/ Meal	-	5-10	-	10	-	10
Pasta	-	5-10	-	5	-	10
Rice, white/ brown	-	-	-	5	-	10
Vegetables	10	10	0*	10	20	10
Vegetables with leaf and steam	10	10		-	-	10
Potatoes	10	10	-	0	20	10
Fruits and berries	10	25	0*	-	20	10
Milk and milk products	10	0	-	0	20	10
Meat	15	10-45	-	-	20	-
Pork	-	20-25	-	-	-	-
Beef	-	20-25	-	25	-	-
Fish	10	10-30	-	15-20	20	10
Low fat fish	-	10	-	20	-	10
Fat fish	-	10-30	-	15	-	10
Eggs	10	0	-	0	-	10
Margarine, butter, oil	-	-	-	-	-	10
Fried						
Bread, grains, flour, pasta, rice	-	10	-	5	-	10
Flour/ Meal	-	10	-	5	-	10
Vegetables	-	0-10	-	15	-	10
Vegetables with leaf and steam	-	10	-	-	-	10
Potatoes	10	10	-	0	-	10
Fruits and berries	-	10	-	-	-	10
Milk and milk products	-	0	-	0	-	10
Meat	15	0-45	-	25	20	-
Pork	-	20	-	-	-	-
Beef	-	15-45	-	25	-	-
Fish	10	10-20	-	15	20	10
Low fat fish	-	10	-	15	-	10
Fat fish	-	15-20	-	15	-	10
Eggs	10	0-10	-	0	-	10
Margarine, butter, oil	-	-	-	-	-	10
Oven baked/Baked/in Dishes						
Bread, grains, flour, pasta, rice	10	10	-	5-10	-	10
Flour/ Meal	-	10	-	10	-	10
Pasta	-	-	-	5	-	10
Vegetables	10	10	0	5	20	10
Vegetables with leaf and steam	10	10		-	20	10
Potatoes	10	10	-	0	-	10
Fruits and berries	-	10	-	-	-	10
Milk and milk products	10	0	-	0	-	10
Meat	15	0-45	-	20-25	-	-
Pork	-	-	-	-	-	-

Beta-Carotene	Norway	Bognar*	McCance	USDA	Poland	Bergström
Beef	-	-	-	25	-	-
Fish	10	15-20	-	10-15	-	10
Low fat fish	-	-	-	10	-	10
Fat fish	-	-	-	15	-	10
Eggs	10	0-10	-	0	-	10
Margarine, butter, oil	-	-	-	-	-	10

* Estimated value, values for all carotenoids

Vitamin D	Bognar	McCance	Poland
Cooked/Boiled			
Bread, grains, flour, pasta, rice	0	-	10
Vegetables	0	-	10
Vegetables with leaf and steam	0	-	10
Potatoes	0	-	10
Fruits and berries	-	-	10
Milk and milk products	0	-	10
Meat	10-25	-	10
Fish	10-30	-	10
Eggs	5	-	10
Margarine, butter, oil	-	-	10
Fried			
Bread, grains, flour, pasta, rice	0	-	-
Vegetables	0	-	-
Vegetables with leaf and steam	0	-	-
Potatoes	0	-	-
Fruits and berries	-	-	-
Milk and milk products	0	-	-
Meat	10-45	-	10
Fish	15-20	0	10
Eggs	0-10	-	-
Margarine, butter, oil	-	-	-
Oven baked/Baked/in Dishes			
Bread, grains, flour, pasta, rice	0	-	-
Vegetables	0	-	-
Vegetables with leaf and steam	0	-	-
Potatoes	0	-	-
Fruits and berries	-	-	-
Milk and milk products	0	-	-
Meat	0-45	-	-
Fish	15-20	0	-
Eggs	0-10	-	-
Margarine, butter, oil	-	-	-

Tocopherol, Vitamin E	Denmark	Norway	Bognar	McCance	Poland
Cooked/Boiled					
Bread, grains, flour, pasta, rice	0	0	0	-	20
Vegetables	0	0	0	0	20
Vegetables with leaf and steam	0	0	0	0	20
Potatoes	0	0	0	-	20
Fruits and berries	0	0	0	-	20
Milk and milk products	20	20	0	20	20
Meat	20	20	0-25	20	20
Fish	0	0	0-30	0	20
Eggs	0	0	0	-	-
Margarine, butter, oil	(25)	-	-	-	-
Fried					
Bread, grains, flour, pasta, rice	0	-	0	-	-
Vegetables	0	-	0	0	-
Vegetables with leaf and steam	0	-	-	0	-
Potatoes	0	0	0	-	-
Fruits and berries	0	-	0	-	-
Milk and milk products	20	-	0	-	-
Meat	20	20	0-45	20	20
Fish	0	0	0-20	0	20
Eggs	0	0	0-10	-	-
Margarine, butter, oil	80	5	-	-	-
Oven baked/Baked/in Dishes					
Bread, grains, flour, pasta, rice	0	0	0	-	-
Vegetables	(0)	0	0	0	-
Vegetables with leaf and steam	(0)	0	0	-	-
Potatoes	(0)	0	0	-	-
Fruits and berries	(0)	-	0	-	-
Milk and milk products	(20)	20	0	-	-
Meat	(20)	20	0-45	-	-
Fish	0	0	0-20	0	-
Eggs	0	0	0-10	-	-
Margarine, butter, oil	(25)	5	-	-	-

Thiamin, Vitamin B1	Denmark	Norway	Bognar	McCance	USDA	Poland	Sweden *	Bergström
Cooked/Boiled								
Bread, grains, flour, pasta, rice	-	20	0-50	-	20-35	25-50	30	25
Flour/ Meal	-	-	20-50	-	20	-	-	25
Pasta	-	-	20-50	-	35	-	-	25
Rice, white/ brown	-	-	0	-	20	-	-	25
Cereals	15	-	0	40	-	-	30	25
Vegetables	25-40	25	10-35	35	15	40	30	25
Vegetables with leaf and steam	40	25	50	-	-	40	30	25
Potatoes	25	25	20-25	-	20	30	30	25
Fruits and berries	25	25	20-35	25	20	30	30	25
Milk and milk products	0	25	10	10-20	10-25	20	30	25
Meat	60	40	40-70	20	45-60	40	30	60
Pork	-	-	40-70	-	-	-	-	60
Beef	-	-	40-60	-	20	-	-	60
Poultry	60	-	30-60	-	-	-	30	60
Fish	(20)	25	20	10	20	40	30	25
Low fat fish	-	-	15-25	-	20	-	-	25
Fat fish	-	-	15-25	-	20	-	-	25
Eggs	10	25	30	-	15	-	30	25
Margarine, butter, oil	(0)	-	-	-	-	-	30	25
Fried								
Bread, grains, flour, pasta, rice	-	-	10	-	20	-	30	30
Flour/Meal	-	-	10-20	-	20	-	-	30
Cereals	(20)	-	-	-	-	-	30	30
Vegetables	(25-40)	-	10	20	15	-	30	30
Vegetables with leaf and steam	(40)	-	10	-	-	-	30	30
Potatoes	(25)	25	20	-	20	-	30	30
Fruits and berries	(25)	-	0	-	20	-	30	30
Milk and milk products	(0)	-	25	-	10-25	-	30	30
Meat	20	40	30-50	20	30	25	30	40
Pork	-	-	30-55	-	-	-	-	40
Beef	-	-	40-55	-	30	-	-	40
Poultry	20	-	30-45	-	-	-	30	40
Fish	20	25	15-20	20	15	25	30	30
Low fat fish	-	-	15-20	-	15	-	-	30
Fat fish	-	-	15-20	-	15	-	-	30
Eggs	15	25	5-30	5	15	-	30	30
Margarine, butter, oil	(0)	-	-	-	-	-	30	30
Oven baked/Baked/in Dishes								
Bread, grains, flour, pasta, rice	-	20	25	-	20	-	30	20
Flour/ Meal	-	-	25	-	20	-	-	20

Thiamin, Vitamin B1	Denmark	Norway	Bognar	McCance	USDA	Poland	Sweden *	Bergström
Pasta	-	-	-	-	20	-	-	20
Cereals	20	-	-	15-25	-	-	30	20
Vegetables	(25-40)	25	10	20	10	-	30	20
Vegetables with leaf and steam	(40)	25	10		10	-	30	20
Potatoes	(25)	25	20	-	15-20	-	30	20
Fruits and berries	(25)		0	-	20	-	30	20
Milk and milk products	(0)	25	25	25	25	-	30	20
Meat	(20)	40	40-55	20	30-55	-	30	45
Poultry	(20)	-	-	-	-	-	30	45
Pork	-	-	-	-	-	-	-	45
Beef	-	-	-	-	55	-	-	45
Fish	30	25	15-25	30	5-10	-	30	20
Low fat fish	-	-	-	-	10	-	-	20
Fat fish	-	-	-	-	5	-	-	20
Eggs	(15)	25	5-30	15	20	-	30	20
Margarine, butter, oil	(0)	-	-	-	-	-	30	20

* Sweden: Values for boiling, roasting and warm preparation in general.

Riboflavin, Vitamin B2	Denmark	Norway	Bognar	McCance	USDA	Poland	Sweden*	Bergström
Cooked/Boiled								
Bread, grains, flour, pasta, rice	-	10	35-50	-	10-25	20-25	25	20
Flour/ Meal	-	-	0-30	-	10	-	-	20
Pasta	-	-	0-30	-	25	-	-	20
Rice, white/ brown	-	-	0-25	-	10	-	-	20
Cereals	10	-	0-25	40	-	-	25	20
Vegetables	30-40	20	30-40	20	5	30	25	20
Vegetables with leaf and steam	40	20	40	-	-	30	25	20
Potatoes	30	20	15-20	-	5	10	25	20
Fruits and berries	35	20	20	25	10	10	25	20
Milk and milk products	10	20	5	10	0	10	25	20
Meat	30	10	5-30	20	5-25	20	25	25
Pork	-	-	0-30	-	-	-	-	25
Beef	-	-	0-20	-	5	-	-	25
Poultry	30	-	0-5	-	-	-	25	25
Fish	10	20	0-30	-	10	20	25	20
Low fat fish	-	-	0-30	-	10	-	-	20
Fat fish	-	-	0-30	-	10	-	-	20
Eggs	5	20	20	-	5	-	25	20
Margarine, butter, oil	(0)	-	-	-	-	-	25	20
Fried								
Bread, grains, flour, pasta, rice	-		0	-	10-15	-	25	15
Flour/ Meal	-	-	0	-	0	-	-	15
Cereals	(5)	-	-	-	-	-	25	15
Vegetables	(30-40)	-	10-20	0	5	-	25	15
Vegetables with leaf and steam	(40)	-	15	-	-	-	25	15
Potatoes	(30)	20	20	-	5	-	25	15
Fruits and berries	(35)		0	-	10	-	25	15
Milk and milk products	(10)	20	5	-	0	-	25	15
Meat	20	10	40-55	20	10	10	25	10
Pork	-	-	0-15	-	-	-	-	10
Beef	-	-	0-15	-	10	-	-	10
Poultry	20	-	0-10	-	-	-	25	10
Fish	20		20-45	20	0-5	10	25	15
Low fat fish	-	-	0-10	-	5	-	-	15
Fat fish	-	-	0-10	-	0	-	-	15
Eggs	10	20	5-30	20	5	-	25	15
Margarine, butter, oil	(0)	0	-	-	-	-	25	15

Riboflavin, Vitamin B2	Denmark	Norway	Bognar	McCance	USDA	Poland	Sweden *	Bergström
Oven baked/Baked/in Dishes								
Bread, grains, flour, pasta, rice	-	10	0	-	10	-	25	10
Flour/ Meal	-	-	0	-	10	-	-	10
Pasta	-	-	-	-	10	-	-	10
Cereals	5	-	-	15	-	-	25	10
Vegetables	(30-40)	20	10	20	5	-	25	10
Vegetables with leaf and steam	(40)	20	15	-	-	-	25	10
Potatoes	(30)	20	20	-	5	-	25	10
Fruits and berries	(35)		0	-	5	-	25	10
Milk and milk products	(10)	20	5	15	0	-	25	10
Meat	(20)	10	30-55	20	5-15	-	25	10
Pork	-	-	-	-	-	-	-	10
Beef	-	-	-	-	0	-	-	10
Poultry	(20)	-	-	-	-	-	25	10
Fish	20	20	20-45	20	0-5	-	25	10
Low fat fish	-	-	-	-	5	-	-	10
Fat fish	-	-	-	-	0	-	-	10
Eggs	(20)	20-	5-30	15	5	-	25	10
Margarine, butter, oil	(0)	-	-	-	-	-	25	10

* Values for boiling, roasting and warm preparation in general.

Niacin, Vitamin B3	Denmark	Norway	Bognar	McCance	USDA	Poland	Sweden*	Bergström
Cooked/Boiled								
Bread, grains, flour, pasta, rice	-	-	5-25	-	0-35	10-40	15	20
Flour/ Meal	-	-	10-35	-	10	-	-	20
Pasta	-	-	10-35	-	35	-	-	20
Rice, white/ brown	-	-	5-25	-	0	-	-	20
Cereals	10	-	5-25	40	-	-	15	20
Vegetables	30-40	20	5-30	30	10	10	15	20
Vegetables with leaf and steam	40	20	5-35	-	-	40	15	20
Potatoes	30	20	30	-	5	40	15	20
Fruits and berries	35	20	10-20	25		25	15	20
Milk and milk products	0	0	5	-	0	10	15	20
Meat	50	20	10-50	-	10	10	15	45
Pork	-	-	20-50	-	-	-	-	45
Beef	-	-	20-50	-	10	-	-	45
Poultry	50	-	20-40	-	-	-	15	45
Fish	15	20	5-30	-	5-15	30	15	20
Low fat fish	-	-	5-30	-	5	-	-	20
Fat fish	-	-	5-30	-	15	-	-	20
Eggs	0	0	20	-	5	30	15	20
Margarine, butter, oil	(0)	-	-	-	-	-	15	20
Fried								
Bread, grains, flour, pasta, rice	-	-	0	-	0	-	15	15
Flour/ Meal	-	-	0	-	0	-	-	15
Cereals	(5)	-	-	-	-	-	15	15
Vegetables	(30-40)	-	5	0	10	-	15	15
Vegetables with leaf and steam	(40)	-	-	-	-	-	15	15
Potatoes	(30)	20	5	-	5	-	15	15
Fruits and berries	(35)	-	0	-		-	15	15
Milk and milk products	(0)	-	5	-	0	-	15	15
Meat	20	20	10-30	20	10-20	0	15	20
Pork	-	-	20-25	-	-	-	-	20
Beef	-	-	20	-	20	-	-	20
Poultry	20	-	20-40	-	-	-	15	20
Fish	20	20	5-10	10-20	0	10	15	15
Low fat fish	-	-	5-10	-	0	-	-	15
Fat fish	-	-	5-10	-	0	-	-	15
Eggs	0	0	5	5	5	-	15	15
Margarine, butter, oil	(0)	-	-	-	-	-	15	15
Oven baked/Baked/in Dishes								
Bread, grains, flour, pasta, rice	-	10	5	-	10	-	15	10
Flour/ Meal	-	-	5	-	10	-	-	10
Pasta	-	-	-	-	10	-	-	10
Cereals	5	-	-	5	-	-	15	10
Vegetables	(30-40)	20	5	20	5	-	15	10
Vegetables with leaf and steam	(40)	20	5	-	-	-	15	10

Niacin, Vitamin B3	Denmark	Norway	Bognar	McCance	USDA	Poland	Sweden *	Bergström
Potatoes	(30)	20	10	-	5	-	15	10
Fruits and berries	(35)	-	0	-	-	-	15	10
Milk and milk products	(0)	0	5	5	0	-	15	10
Meat	(20)	20	10-30	20	45	-	15	20
Pork	-	-	-	-	-	-	-	20
Beef	-	-	-	-	45	-	-	20
Poultry	(20)	-	-	-	-	-	15	20
Fish	20	20	5-10	20	0-5	-	15	10
Low fat fish	-	-	-	-	5	-	-	10
Fat fish	-	-	-	-	0	-	-	10
Eggs	0	-	5	5	10	-	15	10
Margarine, butter, oil	(0)	-	-	-	-	-	15	10

* Values for boiling, roasting and warm preparation in general.

Pantothenic acid, Vitamin B5	Bognar	McCance	Poland	Bergström
Cooked/Boiled				
Bread, grains, flour, pasta, rice	5-25	-	10	30
Cereals	5-25	40	-	30
Vegetables	10-40	-	10	30
Vegetables with leaf and steam	10-30	-	10	30
Potatoes	30	-	10	30
Fruits and berries	10-20	25	10	30
Milk and milk products	10	10	10	30
Meat	10-60	-	10	30
Fish	15-30	-	10	30
Eggs	20	-	-	30
Margarine, butter, oil	-	-	-	30
Fried				
Bread, grains, flour, pasta, rice	20	-	-	20
Vegetables	10	-	-	20
Vegetables with leaf and steam	10-30	-	-	20
Potatoes	10	-	-	20
Fruits and berries	0	-	-	20
Milk and milk products	10	-	-	20
Meat	10-25	20	10	20
Fish	15-20	5-20	10	20
Eggs	20	15	-	20
Margarine, butter, oil	-	-	-	20
Oven baked/Baked/in Dishes				
Bread, grains, flour, pasta, rice	25	-	-	20
Cereals	25	25	-	20
Vegetables	5-15	20	-	20
Vegetables with leaf and steam	10	-	-	20
Potatoes	10	-	-	20
Fruits and berries	0	-	-	20
Milk and milk products	25	25	-	20
Meat	10-30	20	-	20
Fish	15-20	20	-	20
Eggs	20	25	-	20
Margarine, butter, oil	-	-	-	20

Pyridoxin, Vitamin B6	Denmark	Norway	Bognar	McCance	USDA	Poland	Sweden *	Bergström
Cooked/Boiled								
Bread, grains, flour, pasta, rice	-	-	20-50	-	10-20	20-40	20	25
Flour/ Meal	-	-	20	-	10	-	-	25
Pasta	-	-	20	-	10	-	-	25
Rice, white/ brown	-	-	5-25	-	5	-	-	25
Cereals	40	-	5-25	40	-	-	20	25
Vegetables	40	40	30-35	40	10	40	20	25
Vegetables with leaf and steam	40	40	35	-	-	40	20	25
Potatoes	40	40	15-30	-	5	25	20	25
Fruits and berries	40	40	10-30	20	10	20	20	25
Milk and milk products	10	10	10	10	10	20	20	25
Meat	50	20	15-50	50	50-65	30	20	55
Pork	-	-	15-50	-	-	-	-	55
Beef	-	-	20-40	-	40	-	-	55
Poultry	50	-	20-40	-	-	-	20	55
Fish	5	10	15-30	0	20	30	20	25
Low fat fish	-	-	15-30	-	20	-	-	25
Fat fish	-	-	15-30	-	20	-	-	25
Eggs	10	20	20	-	5	-	20	25
Margarine, butter, oil	(0)	-	-	-	-	-	20	25
Fried								
Bread, grains, flour, pasta, rice	-	-	10	-	0	-	20	25
Flour/ Meal	-	-	20	-	0	-	-	25
Cereals	(40)	-	-	-	-	-	20	25
Vegetables	(40)	-	10	25	10	-	20	25
Vegetables with leaf and steam	(40)	-	15	-	-	-	20	25
Potatoes	(40)	40	20	-	5	-	20	25
Fruits and berries	(40)	-	0	-	10	-	20	25
Milk and milk products	(10)	-	25	-	25	-	20	25
Meat	20	20	20-30	20	20-40	25	20	35
Pork	-	-	20	-	-	-	-	35
Beef	-	-	20	-	40	-	-	35
Poultry	20	-	20-30	-	-	-	20	35
Fish	20	10	15-20	20	10	25	20	25
Low fat fish	-	-	15-20	-	10	-	-	25
Fat fish	-	-	15-20	-	10	-	-	25
Eggs	20	20	10	15	5	-	20	25
Margarine, butter, oil	(0)	-	-	-	-	-	20	25

Pyridoxin, Vitamin B6	Denmark	Norway	Bognar	McCance	USDA	Poland	Sweden *	Bergström
Oven baked/Baked/in Dishes								
Bread, grains, flour, pasta, rice	-	10	10	-	10	-	20	20
Flour/Meal	-	-	20-25	-	10	-	-	20
Pasta	-	-	-	-	10	-	-	20
Cereals	25	-	-	25	-	-	20	20
Vegetables	(40)	40	10	20	5	-	20	20
Vegetables with leaf and steam	(40)	40	15	-	-	-	20	20
Potatoes	(40)	40	20	-	5	-	20	20
Fruits and berries	(40)	-	0	-	-	-	20	20
Milk and milk products	(10)	10	25	25	25	-	20	20
Meat	(20)	20	30-55	20	40-50	-	20	40
Pork	-	-	-	-	-	-	-	40
Beef	-	-	-	-	65	-	-	40
Poultry	(20)	-	-	-	-	-	20	40
Fish	10	10	15-20	10	10	-	20	20
Low fat fish	-	-	-	-	10	-	-	20
Fat fish	-	-	-	-	10	-	-	20
Eggs	(20)	20	10	25	5	-	20	20
Margarine, butter, oil	(0)	-	-	-	-	-	20	20

* Values for boiling, roasting and warm preparation in general.

Folate	Norway	Bognar	McCance	USDA**	Poland	Bergström
Cooked/Boiled						
Bread, grains, flour, pasta, rice	-	20-30	-	30	50	30
Flour/ Meal	-	30	-	30	-	30
Pasta	-	30	-	30	-	30
Rice, white/ brown	-	20-30	-	30	-	30
Cereals	-	20-30	50			30
Vegetables	50	30-50	40	30	5-55	30
Vegetables with leaf and steam	50	30-50	-	-	5-55	30
Potatoes	50	50	-	10	50	30
Fruits and berries	50	30-50	80		50	30
Milk and milk products	50	20	20	15	10	30
Meat	50	20-35	-	15	50	30
Pork	-	20-30	-	-	-	30
Beef	-	20-35	-	15	-	30
Fish	50	15-30	-	20	50	30
Low fat fish	-	15-30	-	20	-	30
Fat fish	-	15-30	-	20	-	30
Eggs	20	20	-	25	-	30
Margarine, butter, oil	-	-	-	-	-	30
Fried						
Bread, grains, flour, pasta, rice	-	30	-	15	-	30
Flour/ Meal	-	30	-	15	-	30
Vegetables	-	30	55	30	-	30
Vegetables with leaf and steam	-	-	-	-	-	30
Potatoes	50	25	-	25	-	30
Fruits and berries	-	0	-		-	30
Milk and milk products	-	50	-	20	-	30
Meat	50	5-30	*	15	30	25
Pork	-	15-20	-	-	-	25
Beef	-	15-20	-	15	-	25
Fish	50	15-20	0	10	30	30
Low fat fish	-	15-20	-	10	-	30
Fat fish	-	15-20	-	10	-	30
Eggs	20	30	30	25	-	30
Margarine, butter, oil	-	-	-	-	-	30

Folate	Norway	Bognar	McCance	USDA**	Poland	Bergström
Oven baked/Baked/*in Dishes**						
Bread, grains, flour, pasta, rice	50	50	-	30	-	25
Flour/ Meal	-	50	-	30	-	25
Pasta	-	-	-	30	-	25
Cereals	-	-	50	-	-	25
Vegetables	50	30	50	15	-	25
Vegetables with leaf and steam	50	30	-	-	-	25
Potatoes	50	25	-	25	-	25
Fruits and berries	-	0	-	-	-	25
Milk and milk products	50	50	50	20	-	25
Meat	50	5-30	50	30-45	-	15
Beef	-	-	-	35	-	15
Fish	50	15-20	20	10	-	25
Low fat fish	-	-	-	10	-	25
Fat fish	-	-	-	10	-	25
Eggs	20	30	50	25	-	25
Margarine, butter, oil	-	-	-	-	-	25

*The amount of folate in meat is too low to make meaningful calculations of losses.

** Folate, total.

*** McCance: values for cooked dishes.

Cobalamin, Vitamin B12	Denmark	Norway	Bognar	McCance	USDA	Poland	Bergström
Cooked/Boiled							
Bread, grains, flour, pasta, rice	-	-	0-25	-	0	10	10
Flour/ Meal	-	-	0	-	0	-	10
Pasta	-	-	0	-	0	-	10
Rice, white/ brown	-	-	5-25	-	0	-	10
Cereals	5	-	5-25	-	-	-	10
Vegetables	(0)	-	20-40	-	0	10	10
Vegetables with leaf and steam	(0)	-	30-40	-	-	10	10
Potatoes	(0)	-	30	-	0	10	10
Fruits and berries	(0)	-	10	-	-	10	10
Milk and milk products	5	5	5	5	20-45	10	10
Meat	20	20	20-50	-	20	10	35
Pork	-	-	20-40	-	-	-	35
Beef	-	-	30-40	-	20	-	35
Poultry	20	-	30-50	-	-	10	35
Fish	5	10	10-20	-	15	10	10
Low fat fish	-	-	10-20	-	15	-	10
Fat fish	-	-	10-20	-	15	-	10
Eggs	0	0	20	-	15	-	10
Margarine, butter, oil	(0)	-	-	-	-	-	10
Fried							
Bread, grains, flour, pasta, rice	-	-	0	-	0	-	15
Flour/ Meal	-	-	0	-	0	-	15
Cereals	(40)	-	-	-	-	-	15
Vegetables	(0)	-	5-30	-	0	-	15
Vegetables with leaf and steam	(0)	-	-	-	-	-	15
Potatoes	(0)	-	20	-	0	-	15
Fruits and berries	(0)	-	0	-	-	-	15
Milk and milk products	(5)	-	10	-	45	-	15
Meat	20	20	5-35	20	20	10	20
Pork	-	-	20	-	-	-	20
Beef	-	-	30	-	20	-	20
Fish	0	10	10	0	10-25	10	15
Low fat fish	-	-	10	-	10	-	15
Fat fish	-	-	10	-	25	-	15
Eggs	0	0	5	-	15	-	15
Margarine, butter, oil	(0)	-	-	-	-	-	15
Oven baked/Baked/in Dishes							
Bread, grains, flour, pasta, rice	-	-	0	-	0	-	15
Flour/ Meal	-	-	0	-	0	-	15
Pasta	-	-	-	-	0	-	15
Cereals	(0)	-	-	-	-	-	15
Vegetables	(0)	-	30	-	0	-	15
Vegetables with leaf and steam	(0)	-	30	-	-	-	15
Potatoes	(0)	-	20	-	0	-	15

Cobalamin, Vitamin B12	Denmark	Norway	Bognar	McCance	USDA	Poland	Bergström
Fruits and berries	(0)	-	0	-		-	15
Milk and milk products	(5)	5	10	-	45	-	15
Meat	(20)	20	5-35	20	20-40	-	20
Pork	-	-	-	-	-	-	20
Beef	-	-	-	-	40	-	20
Poultry	(20)	-	-	-	-	-	20
Fish	10	10	10	10	10-15	-	15
Low fat fish	-	-	-	-	10	-	15
Fat fish	-	-	-	-	15	-	15
Eggs	0	0	5	-	20	-	15
Margarine, butter, oil	(0)	-	-	-	-	-	15

Vitamin C	Denmark	Norway	Bognar	McCance	USDA	Poland	Sweden*	Bergström**
Cooked/Boiled								
Bread, grains, flour, pasta, rice	-	35	30	-	20-30	-	50	35
Flour/ Meal	-	-	30	-	20	-	-	35
Pasta	-	-	30	-	30	-	-	35
Rice, white/ brown	-	-	30	-	20	-	-	35
Cereals	50	-	30	-	-	-	50	35
Vegetables	40-70	35	10-55	45	20	50	50	35
Vegetables with leaf and steam	70	35	55	-	-	50	50	35
Potatoes	40	35	15-30	-	25	75	50	35
Fruits and berries	50	25	30-60	25	30	75	50	35
Milk and milk products	50	35	30	50	15-35	-	50	35
Meat	20	25	15-30	-	20-25	-	50	25
Pork	-	-	20	-	-	-	-	25
Beef	-	-	25	-	20	-	-	25
Poultry	20	-	20	-	-	-	50	25
Fish	(20)	35	15-20	-	25	-	50	35
Low fat fish	-	-	15-20	-	25	-	-	35
Fat fish	-	-	15-20	-	25	-	-	35
Eggs	0	-	20	-	20	-	50	35
Margarine, butter, oil	(0)	-	-	-	-	-	50	35
Fried								
Bread, grains, flour, pasta, rice	-	-	25	-	15	-	50	40
Flour/ Meal	-	-	15	-	15			40
Cereals	(0)	-	-	-	-	-	50	40
Vegetables	(40-70)	-	25	30	15	-	50	40
Vegetables with leaf and steam	(70)	-	30	-	-	-	50	40
Potatoes	(40)	35	20	-	20	-	50	40
Fruits and berries	(50)	-	0	-	30	-	50	40
Milk and milk products	(50)	-	30	-	35	-	50	40
Meat	20	25	15-25	***	20	-	50	25
Pork	-	-	20	-	-	-	-	25
Beef	-	-	25	-	20	-	-	25
Poultry	20	-	20	-	-	-	50	25
Fish	(20)	35	15-20	-	20	-	50	40
Low fat fish	-	-	15-20	-	20	-	-	40
Fat fish	-	-	15-20	-	20	-	-	40
Eggs	0	-	20	-	20	-	50	40
Margarine, butter, oil	(0)	-	-	-	-	-	50	40

Vitamin C	Denmark	Norway	Bognar	McCance	USDA	Poland	Sweden *	Bergström **
Oven baked/Baked/in Dishes								
Bread, grains, flour, pasta, rice	-	35	30	-	20	-	50	30
Flour/ Meal	-	-	30	-	20	-	-	30
Pasta	-	-	-	-	20	-	-	30
Cereals	0	-	-	-	-	-	50	30
Vegetables	(40-70)	35	25	50	15	-	50	30
Vegetables with leaf and steam	(70)	35	30	-	-	-	50	30
Potatoes	(40)	35	20	-	20	-	50	30
Fruits and berries	(50)	-	0	-	20	-	50	30
Milk and milk products	(50)	35	30	-	35	-	50	30
Meat	(20)	25	15-25	50	15-20	-	50	25
Pork	-	-	-	-	-	-	-	25
Beef	-	-	-	-	20	-	-	25
Poultry	(20)	-	-	-	-	-	50	25
Fish	(20)	35	15-20	-	20	-	50	30
Low fat fish	-	-	-	-	20	-	-	30
Fat fish	-	-	-	-	20	-	-	30
Eggs	0	-	20	-	20	-	50	30
Margarine, butter, oil	(0)	-	-	-	-	-	50	30

* Values for boiling, roasting and warm preparation in general.
** Bergström: the values for meat and poultry refer to 'liver'.
*** The amount of vitamin C in meat is too low to make meaningful calculations of losses.

Sodium, Na	Denmark	Bognar*	USDA	Poland
Cooked/Boiled				
Bread, grains, flour, pasta, rice	5	20-40	0-50	10
Flour/ Meal	-	50	0	-
Pasta	-	50	50	-
Rice, white/ brown	-	0-40	0	-
Vegetables	5	20-55	5	10
Vegetables with leaf and steam	5	25	-	10
Potatoes	5	20-40	5	10
Fruits and berries	5	0-40	0	10
Milk and milk products	5	0	0	10
Meat	5	55-60	15-45	10
Pork	-	0-55	-	-
Beef	-	0-55	15	-
Fish	5	0-15	10	10
Low fat fish	-	0-15	10	-
Fat fish	-	0-15	10	-
Eggs	5	0	0	-
Margarine, butter, oil	5	-	-	-
Fried				
Bread, grains, flour, pasta, rice	0	0	0	-
Flour/ Meal	-	0	0	-
Vegetables	0	0	0	-
Vegetables with leaf and steam	0	0	-	-
Potatoes	0	0	0	-
Fruits and berries	0	0	0	-
Milk and milk products	0	0	0	-
Meat	0	15-50	10-20	10
Pork	-	0-15	-	-
Beef	-	0-15	15	-
Fish	0	0-15	0	10
Low fat fish	-	0-15	0	-
Fat fish	-	0-15	0	-
Eggs	0	0	0	-
Margarine, butter, oil	0	-	-	-
Oven baked/Baked/in Dishes				
Bread, grains, flour, pasta, rice	0	0	0	-
Flour/ Meal	-	0	0	-
Pasta	-	-	0	-
Vegetables	0	0	0	-
Vegetables with leaf and steam	0	40	-	-
Potatoes	0	0	0	-
Fruits and berries	0	0	0	-
Milk and milk products	0	0	0	-
Meat	0	15-50	20-45	-
Pork	-	-	-	-

Sodium, Na	Denmark	Bognar*	USDA	Poland
Beef	-	-	45	-
Fish	0	0-15	0	-
Low fat fish	-	-	0	-
Fat fish	-	-	0	-
Eggs	0	0	0	-
Margarine, butter, oil	0	-	-	-

* Without cooking salt.

Potassium, K	Denmark	Bognar	USDA	Poland
Cooked/Boiled				
Bread, grains, flour, pasta, rice	5	0-45	0-70	10
Flour/ Meal	-	35-40	0	-
Pasta	-	35-40	70	-
Rice, white/ brown	-	0-45	5	-
Vegetables	5	0-55	10	10
Vegetables with leaf and steam	5	0-50	-	10
Potatoes	5	0-20	0	10
Fruits and berries	5	0-40	-	10
Milk and milk products	5	0	0	10
Meat	5	0-50	15	10
Pork	-	0-50	-	-
Beef	-	0-50	15	-
Fish	5	0-25	15	10
Low fat fish	-	0-25	15	-
Fat fish	-	0-25	15	-
Eggs	5	0	0	-
Margarine, butter, oil	5	-	-	-
Fried				
Bread, grains, flour, pasta, rice	0	0	0	-
Flour/ Meal	-	0	0	-
Vegetables	0	0	0	-
Vegetables with leaf and steam	0	-	-	-
Potatoes	0	0	0	-
Fruits and berries	0	0		-
Milk and milk products	0	0	0	-
Meat	0	0-40	15	10
Pork	-	0-40	-	-
Beef	-	0-40	15	-
Fish	0	0-15	0	10
Low fat fish	-	0-15	0	-
Fat fish	-	0-15	0	-
Eggs	0	0	0	-
Margarine, butter, oil	0	-	-	-
Oven baked/Baked/in Dishes				
Bread, grains, flour, pasta, rice	0	0	0	-
Flour/ Meal	-	0	0	-
Pasta	-	-	0	-
Vegetables	0	0	0	-
Vegetables with leaf and steam	0	0	-	-
Potatoes	0	0	0	-
Fruits and berries	0	0		-
Milk and milk products	0	0	0	-
Meat	0	15-40	0-45	-
Pork	-	-	-	-
Beef	-	-	45	-

Potassium, K	Denmark	Bognar	USDA	Poland
Fish	0	0-15	0	-
Low fat fish	-	-	0	-
Fat fish	-	-	0	-
Eggs	0	0	0	-
Margarine, butter, oil	0	-	-	-

Calcium, Ca	Denmark	Bognar	USDA	Poland
Cooked/Boiled				
Bread, grains, flour, pasta, rice	5	5	0-5	10
Flour/ Meal	-	5	0	-
Pasta	-	5	5	-
Rice, white/ brown	-	0	0	-
Vegetables	5	0-5	5	10
Vegetables with leaf and steam	5	0-5	-	10
Potatoes	5	5	0	10
Fruits and berries	5	0-5	-	10
Milk and milk products	5	0	0	10
Meat	5	0-20	0	10
Pork	-	0-20	-	-
Beef	-	0-20	0	-
Fish	5	0	0	10
Low fat fish	-	0	0	-
Fat fish	-	0	0	-
Eggs	5	0	0	-
Margarine, butter, oil	5	-	-	-
Fried				
Bread, grains, flour, pasta, rice	0	0	0	-
Flour/ Meal	-	0	0	-
Vegetables	0	0	0	-
Vegetables with leaf and steam	0	-	-	-
Potatoes	0	0	0	-
Fruits and berries	0	0		-
Milk and milk products	0	0	0	-
Meat	0	0-10	0	10
Pork	-	0-10	-	-
Beef	-	0-40	0	-
Fish	0	0	0	10
Low fat fish	-	0	0	-
Fat fish	-	0	0	-
Eggs	0	0	0	-
Margarine, butter, oil	0	-	-	-
Oven baked/Baked/in Dishes				
Bread, grains, flour, pasta, rice	0	0	0	-
Pasta	-	-	0	-
Vegetables	0	0	0	-
Vegetables with leaf and steam	0	0	-	-
Potatoes	0	0	0	-
Fruits and berries	0	0		-
Milk and milk products	0	0	0	-
Meat	0	0-10	20	-
Pork	-	-	-	-
Beef	-	-	20	-
Fish	0	0	0	-

Calcium, Ca	Denmark	Bognar	USDA	Poland
Low fat fish	-	-	0	-
Fat fish	-	-	0	-
Eggs	0	0	0	-
Margarine, butter, oil	0	-	-	-

Magnesium, Mg	Denmark	Bognar	USDA	Poland
Cooked/Boiled				
Bread, grains, flour, pasta, rice	5	0-15	0-5	10
Flour/ Meal	-	15	0	-
Pasta	-	15	0	-
Rice, white/ brown	-	0	0	-
Vegetables	5	0-40	5	10
Vegetables with leaf and steam	5	5	-	10
Potatoes	5	5-10	0	10
Fruits and berries	5	0-20		10
Milk and milk products	5	0	0	10
Meat	5	0-40	15	10
Pork	-	0-40	-	-
Beef	-	0-40	15	-
Fish	5	0-15	10	10
Low fat fish	-	0-15	10	-
Fat fish	-	0-15	10	-
Eggs	5	0	0	-
Margarine, butter, oil	5	-	-	-
Fried				
Bread, grains, flour, pasta, rice	0	0	0	-
Flour/ Meal	-	0	0	-
Vegetables	0	0	0	-
Vegetables with leaf and steam	0	-	-	-
Potatoes	0	0	0	-
Fruits and berries	0	0	-	-
Milk and milk products	0	0	0	-
Meat	0	0-15	15	10
Pork	-	0-15	-	-
Beef	-	0-15	15	-
Fish	0	0-10	0	10
Low fat fish	-	0	0	-
Fat fish	-	0-10	0	-
Eggs	0	0	0	-
Margarine, butter, oil	0	-	-	-
Oven baked/Baked/in Dishes				
Bread, grains, flour, pasta, rice	0	0	0	-
Flour/ Meal	-	0	0	-
Pasta	-	-	0	-
Vegetables	0	0	0	-
Vegetables with leaf and steam	0	0	-	-
Potatoes	0	0	0	-
Fruits and berries	0	0		-
Milk and milk products	0	0	0	-
Meat	0	0-15	0-35	-
Pork	-	-	-	-
Beef	-	-	35	-

Magnesium, Mg	Denmark	Bognar	USDA	Poland
Fish	0	0-10	0	-
Low fat fish	-	-	0	-
Fat fish	-	-	0	-
Eggs	0	0	0	-
Margarine, butter, oil	0	-	-	-

Phosphor, P	Denmark	Bognar	USDA	Poland
Cooked/Boiled				
Bread, grains, flour, pasta, rice	5	5	0-5	10
Flour/ Meal	-	5	0	-
Pasta	-	5	0	-
Rice, white/ brown	-	0	5	-
Vegetables	5	0-10	10	10
Vegetables with leaf and steam	5	0-10	-	10
Potatoes	5	5	0	10
Fruits and berries	5	0-20	-	10
Milk and milk products	5	0	0	10
Meat	5	0-40	10	10
Pork	-	0-40	-	-
Beef	-	0-40	10	-
Fish	5	0-15	10	10
Low fat fish	-	0-15	10	-
Fat fish	-	0-15	10	-
Eggs	5	0	0	-
Margarine, butter, oil	5	-	-	-
Fried				
Bread, grains, flour, pasta, rice	0	0	0	-
Flour/ Meal	-	0	0	-
Vegetables	0	0	0	-
Vegetables with leaf and steam	0	-	-	-
Potatoes	0	0	0	-
Fruits and berries	0	0	-	-
Milk and milk products	0	0	0	-
Meat	0	0-15	10	10
Pork	-	0-15	-	-
Beef	-	0-15	10	-
Fish	0	0-10	0	10
Low fat fish	-	0-10	0	-
Fat fish	-	0-10	0	-
Eggs	0	0	0	-
Margarine, butter, oil	0	-	-	-
Oven baked/Baked/in Dishes				
Bread, grains, flour, pasta, rice	0	0	0	-
Flour/ Meal	-	0	0	-
Pasta	-	-	0	-
Vegetables	0	0	0	-
Vegetables with leaf and steam	0	0	-	-
Potatoes	0	0	0	-
Fruits and berries	0	0	-	-
Milk and milk products	0	0	0	-
Meat	0	0-15	0-35	-
Pork	-	-	-	-
Beef	-	-	35	-

Phosphor, P	Denmark	Bognar	USDA	Poland
Fish	0	0-10	0	-
Low fat fish	-	-	0	-
Fat fish	-	-	0	-
Eggs	0	0	0	-
Margarine, butter, oil	0	-	-	-

Iron, Fe	Bognar	McCance	USDA	Poland
Cooked/Boiled				
Bread, grains, flour, pasta, rice	25	-	0-25	10
Flour/ Meal	25	-	0	-
Pasta	25	-	25	-
Rice, white/ brown	0	-	5	-
Vegetables	0-25	-	5	10
Vegetables with leaf and steam	0-25	-	-	10
Potatoes	5-10	-	0	10
Fruits and berries	0-10	-	-	10
Milk and milk products	0	-	0	10
Meat	0-20	-	5	10
Pork	0	-	-	-
Beef	0	-	5	-
Fish	0-20	-	0	10
Low fat fish	0-20	-	0	-
Fat fish	0-20	-	0	-
Eggs	0	0	0	-
Margarine, butter, oil	-	-	-	-
Fried				
Bread, grains, flour, pasta, rice	0	-	0	-
Flour/ Meal	0	-	0	-
Vegetables	0	-	0	-
Vegetables with leaf and steam	-	-	-	-
Potatoes	0	-	0	-
Fruits and berries	0	-	-	-
Milk and milk products	0	-	0	-
Meat	0-5	-	5	10
Pork	0	-	-	-
Beef	0-4	-	5	-
Fish	0-15	-	0	10
Low fat fish	0-15	-	0	-
Fat fish	0-15	-	0	-
Eggs	0	0	0	-
Margarine, butter, oil	-	-	-	-
Oven baked/Baked/in Dishes				
Bread, grains, flour, pasta, rice	0	-	0	-
Pasta	-	-	0	-
Vegetables	0	-	0	-
Vegetables with leaf and steam	0	-	-	-
Potatoes	0	-	0	-
Fruits and berries	0	-	-	-
Milk and milk products	0	-	0	-
Meat	0-5	-	0	-
Pork	-	-	-	-
Beef	-	-	0	-
Fish	0-15	-	0	-

Iron, Fe	Bognar	McCance	USDA	Poland
Low fat fish	-	-	0	-
Fat fish	-	-	0	-
Eggs	0	0	0	-
Margarine, butter, oil	-	-	-	-

Comments:

Values in brackets () are estimated.

POLAND:

- ‚Cooking' = cooking with decoction poured off

SWEDEN:

- Values for boiling, roasting, warm preparation in general
- Values for Vitamin C, Thiamin, Riboflavin, Niacin, Vit. B6

BERGSTRÖM:

- Retention on recipe level

USDA:

- Further values for Zinc, Copper, Alcohol (ethyl), alpha carotene and other carotenoids are available.
- beef: ground, baked without drippings
- 'Low fat fish' = fish < 5% fat, 'fat fish' = > 5% fat
    o 'Baked' without drippings
    o 'Cooked' means 'simmered without dripping'
    o 'Fried' means with coating
- Vegetable: 'cooked' = boiled with little water, drained
- Flour/ Meal: 'cooked' = boiled, steamed
           'Fried' = toasted
- Pasta: 'cooked' = boiled, drained
- Rice white/ brown: cooked, water used

BOGNÁR:

- Further retention factors (or rather loss values) for the following nutrients are available:
    o fat, carbohydrate, dietary fibre, minerals (ash) in general
    o Copper, Zinc, cooking salt and other minerals
    o Vitamin K, Biotin
    o Amino acids (Lysine, Methionine, Cystine)
    o Organic acids
    o Sterols
    o Purine
    o Other nutrients

- 'Beef' = veal and beef
- 'Flour/ Meal cooked/ boiled' means pasta boiled (as solid part and total dish)
- 'Flour/ Meal baked' includes bread, pizza, cake
- 'rice white/brown' = 'cereals' = cereal grains and seeds, values for 'whole' grains/ seeds and 'polished' ones
- 'Milk and milk products' means always total dishes
- 'poultry' includes chicken, duck and goose, turkey
- Wide ranges are due to differences between:
  - o fry in pan, fry in oven, deep fry
  - o solid, edible part of food or total dish
- Further values for other food groups are available:
  - o stem, flower, corn and seed vs. root, tuber, and bulb vegetable
  - o beans, lentils, peas
  - o potato products
  - o mushrooms
  - o other meat like 'lamb, mutton and game' or minced meat
  - o breaded meat or fish or vegetable
  - o sea food like crab, mussels or squid
  - o bowels like liver, kidney, brain

Appendix 4: Percentage of weight change (yield factors)

The applied systems of European food composition databases:
- Bognár: BfEL, FRI-SK
- McCance & Widdowson: IFR, UCC, CESNID
- USDA: BGU

Weight yield factors by cooking in %	Norway	Bognar[1]	McCance	Poland	Sweden	Italy	Denmark[19]
Cooked/Boiled							
Bread, grains, flour, pasta, rice	-	[+56, +210][15]	[+113,+197][16]	-	+100	[+92, 199][8]	-
Vegetables	-	[-5,-10][13]	-	-	-5	[-43,-1]	-
Vegetables with leaf and steam	-	[+3,+15]/[-1,-4][2]	-	-	-	-	-
Potatoes	-	[-20,+4][14]	-	-	-	0	-
Fruits and berries	-	[+15,+300][3]	-	-	-	-	-
Milk and milk products	-	-5[9]	-	-	-	-	-
Meat	-30	[-30,-40][11]	-29[17]	-	-	[-34,-10]	[-36.6, -27][20]
Fish	[-20, -15]	[-33,-49][12]	+19[18]	-1	-	[-35,-16]	-
Eggs	-	-10	-	-	-	-	-
Margarine, butter, oil	-	-	-	-	-	-	-
Fried							
Bread, grains, flour, pasta, rice	-	[-7,-22][15]	[-11,-29][5]	-	-	-	-
Vegetables	-	-	-	-	-	[-40,-20]	-
Vegetables with leaf and steam	-	-	-	-	-	-	-
Potatoes	-	[-17,-46][14]	-	-	-	-36	-
Fruits and berries	-	-	-	[-20,-14]	-	-	-
Milk and milk products	-	-5	-	-	-	-	-
Meat	[-25,-30]	[-26,-43][11]	[-38,-5][17]	[-3,-17]	-	[-26,-12]	-
Fish	[-5,-20]	[-46,-17][12]	[-23,+2][7]	-27	-	[-60,-22]	-
Eggs	-10	[- 9,-13][10]	-	-	-	-10	-
Margarine, butter, oil	-	-	-	-	-	-	-
Oven baked/Baked/in Dishes							
Bread, grains, flour, pasta, rice	-	[-9,-28][4]	-	-	-	-	-
Vegetables	-	-	-	-	-	-	-
Vegetables with leaf and steam	-	-	-	-	-	[-60,-4]	-
Potatoes	-	-32[14]	-	-	-	-	-
Fruits and berries	-	-	-	-	-	-	-
Milk and milk products	-	-5	-	-	-	-	-
Meat	-	-33	-5[26]	-	-	[-33,-11]	-
Fish	-	-12	-19[27]	-	-	[-37,-21]	-
Eggs	-	-11[10]	-	-	-	-	-
Margarine, butter, oil	-	-	-	-	-	-	-

Comments:

1)	Mean value of available data, edible part of food
2)	Weight gain: e.g. brussels sprouts, boiled. Weight loss: e.g. red cabbage, boiled.
3)	Boiled apples: +300, pears stewed: +15
4)	-28: biscuits, -9: lemon cake
5)	Bread, Cakes, Muffins, fried or toasted.
6)	weight gain: large ravioli fried, weight loss: pancake
7)	weight gain: fish cakes, weight loss: fried (fatty) fish, fish fingers fried
8)	only cooked pasta
9)	Cheese soufflé, vanilla/chocolate blancmange
10)	Fried egg/ scrambled egg; baked: Pancake
11)	Pork and beef, fried: pork chop -47
12)	Cooked: -49: cod (whole), -33: fish fillet (cod, red fish, pollack); fried: -42: Trout "Müllerin style", -10: fish fingers, breaded, deep fried
13)	Root and tuber vegetables
14)	Potato, with peel: -20, without peel: 0; potato dumpling [+3,+9], Fried: -46: French fries deep fried, -17: potato pancake; Baked: -32: potato croquette , deep fried and baked
15)	Boiled: +210: outs flakes, wholemeal; +56: small pasta, wheat flour with egg, fried: -22: wheat, wholemeal, roasted, -7: pancake, wheat flour
16)	+113: Spaghetti, white, dried, boiled; +197: Savoury rice, cooked
17)	Boiled: -29: Beef, silverside, salted; Fried: -38: veal, escalope, -5: chicken breast in crumbs; baked: chicken pie (chilled/frozen)
18)	Cooked: cod dried, salted, boiled; Baked: cod fillets
19)	Reference: Clausen, J. and Ovesen, L.: "Proximate Contents, losses and Gains of Fat, Protein and Water Comparing Raw, Hospital- and Household-Cooked Pork Cuts" Journal of Food Compositions and Analysis (2001) 14, 491-503
20)	Pork, loin boneless with rind

Description of the use of yield factors in the USDA National Nutrient Database:

Basically, yields for products other than meats may be used when analytical data are not available. However, in most cases analytical data for raw and cooked foods and not yield factors is applied. Analytical data for most nutrients for the raw and cooked products in the field of cereals, grains and pasta are most available. If there is missing data for a nutrient in the cooked food, it is calculated from the raw (dry) grain using the moisture values (solids) for raw and cooked rather than using yield factors.

Baked Products:
Food cooking yield factors reflect the changes due primarily to moisture and fat gains and/or losses. When recipe or formulations are used to impute nutrients for processed/formulated foods a percent moisture loss is normally applied not a yield factor. A good example of this would be a cake mix prepared by recipe. The data in column A represent the batter and indicates no moisture loss during baking. Data in column B reflects a 12% loss in weight due to moisture loss. The 12% moisture loss would be applied to the whole recipe and not an 88% yield factor.

Nutrient	Cake batter (A)	Cake bake (B)
Water	41.8g	33.9g
Protein	3.89g	4.42g
Ash	1.59g	1.81g

However, several food items in SR don't have moisture losses applied because analytical data for both the raw and cooked food items are available.

Meats:

When analytical data is available for a food item (e.g. accurate data for cooked beef, pork, and alternate red meat products such as buffalo and ostrich), yield factors are not used. Yield factors are used for calculation, when only raw data is available and cooked data (and vice versa) is needed. Then yield factors from Handbook 102 are used.[30]

Examples of weight and water loss factors in dishes in the Dutch nutrient database NEVO:

Product Name	Weight loss in %	Water loss in %
Almond filled pastry	25	74,9
Apple pie Dutch	9	19
Cake plain	10	38
Cream puff pastry mille	15	28
Flan with fruit filling	5	8
Flan filled with rice pudding	20	33
Treacle waffle	8	22
Butter cake	3	17
Pizza with cheese and tomatoes	25	47
Apple puff pastry	25	53

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[30] Handbook 102: Matthews, R.H., and Garrison, Y.J. (1975). Food yields summarized by different stages of preparation. U.S. Department of Agriculture, Agriculture.