Project no.FP6 - 513944

EuroFIR

EUROPEAN FOOD INFORMATION RESOURCE NETWORK

Instrument: Network of Excellence

Thematic Priority: 5 – Food Quality and Safety

D2.2.9 Report on collection of rules on use of recipe calculation procedures including the use of yield and retention factors for imputing nutrient values for composite foods

Due date of milestone or deliverable: 30.04.2007
Actual submission date: 07.09.2007

Start Date: January 01, 2005 Duration: 5 years

BFEL

Revision [draft 1] in agreement with compiler network WP1.8

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level (please check appropriate box)		
PU	Public	
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

This work was completed on behalf of the EuroFIR consortium and funded under the EU 6th Framework Food Quality and Safety Programme

Contents

Authors: Ana Lucía Vásquez-Caicedo (BFEL), Simone Bell (BFEL), Bernd Hartmann (BFEL) in collaboration with standards development WP1.5 and the compiler network WP1.8

1 GLOSSARY

The following definitions have been adopted from the EuroFIR “Proposal for the harmonisation of recipe calculation procedures” (Reinivuo and Laitinen, April 2007)

Food: Raw food or dish intended for human consumption.

Dish: A food that has been prepared at home or by industrial or catering processes.

Ingredient: A food item included in a recipe.

Recipe: A list of ingredients, including the amounts, which are needed to prepare a dish.

Edible portion: Term refers to the edible material remaining after the inedible waste (e.g. bones, stones, and peel) has been trimmed away.

Yield factor: Term is used for what is retained in weight after food preparation, processing or other treatment. Weight change is a result of moisture (e.g. water) and solid (e.g. fat) losses or gains.

Retention factor: Term is used for what is retained in nutrient content after food preparation, processing or other treatment. This is usually applied to changes in water, fat, vitamin and mineral content.

NLG factors: Nutrient losses and gains (NLG) factors are a general term, which includes both yield and retention factors. It is recommended to use the terms yield and nutrient retention factors instead of NLG factors.

Ingredient level: Term is used when yield factor is applied separately to the weight of each ingredient or when retention factor is applied separately to nutrient content of each ingredient.

Recipe level: Term is used when yield factor is applied to the whole weight of a dish or retention factor is applied to the total nutrient content of a dish.

2 INTRODUCTION

The use of “weight yield” (fat/water and alcohol) and “nutrient retention” factors is directly related with recipe calculation procedures for composite foods. This way, the nutrient content of prepared foods can be estimated from its individual ingredients for its publication in Food Composition Databases (FCDB), labels and special diets. Missing values in analysed food items can be calculated via these factors as well. Furthermore, because most foods are consumed in a cooked or prepared form, the use of these factors is highly relevant for the assessment of the nutrient intake of the population in nutrition surveys.

As already discussed in a previous report (Bell et al. 2006), analysing composite foods is expensive and time consuming. Therefore, determination and appropriate use of nutrient retention and weight yield factors for calculation of the nutrient content in prepared and/or processed foods is an important task that should be addressed by FCDB compilers. Currently, the use the factors available in the literature (e.g. Bógnar; McCance & Widdowson; USDA) is still a source of discrepancies among the European FCDB. This is a not only a consequence of the use of different sources of factors but also a result of a lack of the consistent use of them.

An exhaustive literature review on degradation kinetics and nutrient retention in processed and cooked foods has been carried out by Bergström (1994). This same work has provided a collection of yield factors for foods and dishes used in Europe at that time. Recently, Bell et al. (2006) have published an overview of the nutrient retention factors used by the European FCDB, presenting information provided by 17 EuroFIR partners, such as source of factors used and the availability of retention factor by nutrient. This work also illustrates the ranges of values for nutrient retention being currently used, systematically arranged by food group. However, as a result of the works mentioned above, it is evident that clear recommendations on which factors should be applied, how and in which situation are still missing.

The EuroFIR Compiler Network has decided unanimously during its first meeting (Paris, March 2007), that to reach the goal of harmonising the recipe calculation procedure, the use and selection of retention factors should follow consistent rules. This solution may sometimes be at the expense of the accuracy of the data, but

comparability of the values obtained by a single calculation procedure is a compromise that all compilers have accepted, which is an important step towards the harmonisation of the European FCDB.

To date, the EuroFIR proposal for the harmonisation of recipe calculation procedures (Reinivuo and Laitinen, April 2007) has been finalised, concluding the following:

- **Weight yields** should be applied at **recipe level**
- **Nutrient retention factors** should be applied at **ingredient level**.

Furthermore, due to the large variety of recipes available for each participating country, it has been suggested that each compiler uses its own weight yield factors. However, compilers are still committed to provide the values they have used together with some background information, in order to fulfil the EuroFIR value documentation requirements.

The present work will focus on the use of the nutrient retention factors, which should be on the line of the EuroFIR food classification and the cooking methods available in the LanguaL thesaurus (Facet G). Additionally, a brief overview on weight yield factors, including recommendations and calculation procedures will be discussed. Finally, examples on the use of the factors and special cases on the calculation of recipes will be provided.

A selection of factors is also attached to this proposal for its application in European FCDB, however, the task of validating these values should continue to ensure reliable calculation of nutrient content in composite foods.

3 YIELD FACTORS

Generally, raw foods undergo weight changes after preparation, processing or any other treatment. These changes depend on several factors, such as type of ingredients, cooking method, temperature, time and equipment used (e.g. at household or industrial level).

During cooking, the following changes may occur (Bógnar, 2002):

- Water absorption (e.g. after cooking rice or pasta)
- Water reduction (e.g. after baking bread)
- Alcohol reduction (e.g. in sauces)
- Fat uptake (e.g. fried potatoes)
- Salt absorption (Sodium chloride, e.g. in boiling water)

Furthermore, some dishes can include certain ingredients during their preparation that may not be edible and need to be removed. This is the case of some spices, such as cloves or laurel, which are mostly used for their taste. Also, some foods are cooked with inedible parts, such as boiled eggs with shells or chicken with bones. Besides, some dishes contain a solid and a liquid part or gravy (e.g. goulash), which is sometimes considered drippings and are not always consumed. These cases need to be carefully considered.

Most European FCDB publish their data in nutrient content per 100 g edible portion. Therefore, the calculation steps needed to estimate the nutrient content in a recipe or prepared dish per 100 g edible portion should accurately be evaluated for each recipe. Due to their experience with local recipes, it is advisable that each compiler assumes the responsibility of documenting their own weight yield factors. If no experiments have been carried out, yield factors can be borrowed from similar dishes when available in the literature, such as Bógnar (2002), Bergström (1994) or Martins (1998).

3.1 Calculation of weight yield factors (YF)

Bógnar (2002) has published several algorithms for the calculation of weight yield. Although most calculations are carried out on an edible part basis, some FCDB may want to publish data of certain dishes including the waste (e.g. bones). For this reason, the calculation of yield factors including waste is also briefly described. The following equations have been adapted from the mentioned work and examples have been added for better understanding. Note that the cooking medium (water or fat) is not included in any of the following calculations.

a) Weight yield factor, including waste ($YF_{with\ waste}$):

$$YF_{with\ waste} = \frac{\text{Prepared dish, including waste (g)}}{\text{Total quantity of ingredients (ready-to-cook) (g)}}$$

The weight yield, including waste, for the solid and the liquid part of a dish can be calculated in a similar way.

Examples: a) Roasted chicken with bones and skin:

$$YF_{with\ waste} = \frac{\text{Roasted chicken, whole (g)}}{\text{Raw chicken, whole + other ingredients (g)}}$$

b) Pot roast lamb (leg), with bones and gravy :

- Whole dish: $YF_{with\ waste} = \frac{\text{Pot roast lamb, with bones and gravy (g)}}{\text{Raw lamb meat, whole + other ingredients (g)}}$

- Solid part: $YF_{with\ waste} = \frac{\text{Pot roast lamb, with bones (g)}}{\text{Raw lamb meat, whole + other ingredients (g)}}$

- Liquid part: $YF_{with\ waste} = \frac{\text{Gravy, with waste* (g)}}{\text{Raw lamb meat, whole + other ingredients (g)}}$

* Gravy may not contain waste. However, some spices such as laurel could be present and need to be removed before being consumed.

b) Yield factor, edible part (YF_{edible})

$$YF_{edible} = \frac{\text{Prepared dish, edible part (g)}}{\text{Total quantity of ingredients (ready-to-cook) (g)}}$$

or

$$YF_{edible}{}^{*} = \frac{\text{(Prepared dish, whole) x((100- \%waste)/100) (g)}}{\text{Total quantity of ingredients (ready-to-cook) (g)}}$$

* Some recipes are unavoidably prepared with inedible parts (e.g. roasted chicken with bones). In order to convert the weight of the prepared dish into edible part, it is necessary to subtract the waste. If an in-house table with percentages of waste for common foods is not available, this can be borrowed from other sources (e.g. EPIC project).

The weight yield, edible part, for the solid and the liquid part of a dish can be calculated in a similar way, as described above.

Examples: a) Roasted chicken, meat only (without bones and skin):

$$YF_{edible} = \frac{\text{Roasted chicken, meat (g)}}{\text{Raw chicken, whole + other ingredients (g)}}$$

In this case, the following calculation may be necessary:

$$YF_{edible^*} = \frac{\text{(Roasted chicken, whole) x ((100-\% waste)/100)(g)}}{\text{Raw chicken, whole + other ingredients (g)}}$$

% waste = 25 % (Source: German Nutrient Database)

Therefore, $$YF_{edible^*} = \frac{\text{Roasted chicken, whole x 0.75 (g)}}{\text{Raw chicken, whole + other ingredients (g)}}$$

b) Pot roast pork, with gravy:

- Whole dish: $$YF_{edible} = \frac{\text{Pot roast pork, with gravy, edible part (g)}}{\text{Pork meat, whole + other ingredients (g)}}$$

- Solid part: $$YF_{edible} = \frac{\text{Pot roast pork, solid part (edible) (g)}}{\text{Pork meat, whole + other ingredients (g)}}$$

- Liquid part: $$YF_{edible} = \frac{\text{Gravy (g)}}{\text{Pork meat, whole + other ingredients (g)}}$$

The former examples should serve as a guide on how to calculate yield factors. In practice, some problems may arise while calculating the edible part of a prepared food or even the weight of the ingredients “ready to cook”. For instance, some vegetables need to be washed, peeled or part or them need to be removed before getting into the “ready to cook” stage. A detailed protocol recording the changes in weight during all these preparation steps is usually needed, unless each “ready to cook” ingredient is weighed right before being added to the recipe.

4 NUTRIENT RETENTION FACTORS

The amount of nutrients retained in foods after preparation, processing or other any treatment depend on several factors, such as temperature, time, pressure and many other cooking parameters. Furthermore, nutrient content is closely related to changes in fat and water. Consequently, weight yield factors are included in the experimental determination of the nutrient retention factors.

The general equation to calculate nutrient retention is as follows:

$$RF = \frac{\text{Nutrient content* per 100 g dish, edible part}}{\text{Nutrient content per 100 g of ingredients (ready-to-cook), edible part}} \times YF_{edible}$$

* Nutrient content could be expressed in g, mg or µg, depending on the nutrient

Note that in this equation all values are experimental (analysed). Retention factors can be expressed as values between 0 and 1 or as a percentage of retention (0 to 100%).

According to Bell et al. (2006) most European FCDB use retention factors only for vitamins, minerals and trace elements. The latter report also showed that most European compilers borrow their retention factors from published data, being the works published by Bógnar (2002), McCance & Widdowson (2005), USDA (Release 18), and the Danish FCDB the most frequently used sources.

Many works dealing with degradation kinetic of nutrients (generally vitamins) are available in the literature, but mostly refer to very specific experiments and cannot always be extrapolated to a whole food group. Ideally, nutrient retention factors should be available for each food item/cooking method combination. However the use of these factors organised by food groups (including some sub-groups) is the common practice in FCDB. This is a result of many years of experience and laboratory work, showing that nutrient retention in certain foods are similar after cooking under same conditions (e.g. red meat, roasted). Consequently, average nutrient retention factors are usually applied for foods belonging to a same group or sub-group, prepared under similar conditions and resulting in similar dishes.

4.1 Nutrient retention factors and the EuroFIR Food Classification System

As explained above, the use of average nutrient retention factors is a common practice in FCDBs. However, each source of factors uses a different system to build food groups. Also, each compiler usually matches or adapts the available factors to the food groups present in their respective databases. This is the first problem that the EuroFIR compilers should tackle, by organising the factors by a consistent food classification system. For this reason, the use of the newly developed EuroFIR Food Classification System is recommended.

This proposal aims at providing clear rules for the use of the factors available in the literature. However, the first step towards this goal is to make recommendations for the matching and selection of factors by food group, as presented in Table 1. Notice that this table was developed only for vitamins. It is assumed that the same scheme can be used for minerals, trace elements and other nutrients, but data must still be validated.

As shown in Table 1, the EuroFIR classification system has three levels, which correspond to the tree structure also available in the LanguaL indexing software (facet A). The higher the level, the more detailed information about the food items is available. In fact, this classification system has more levels for certain food groups. For instance, “Milk, milk product or milk substitute” is a main food group (first level), and can be followed by several sub-groups, such as “cheese” (second level), “cured cheese” (third level) and “extra hard cheese” (fourth level). Since most factors available in the literature provide very little information and mostly match only with the first level or main food group (e.g “Milk, milk product or milk substitute”) it was decided not to go into much detail and three levels were considered enough. The LanguaL codes have been included, this way, the compilers should be able to logically follow the recommendations of this table and eventually use this match for programming their own software.

Notice that the recommendations given in Table 1 apply only for foods prepared at household level. Some of the food items in this classification are usually industrially processed and consumed without further preparation. For this reason, the comment

“not applicable” was included. Cooking methods available in the facet G of the LanguaL thesaurus are assumed.

In some cases, retention factors are available for specific products not listed in the EuroFIR food classification system or LanguaL facet A, but may be found in the LanguaL facet B (food source). For instance, specific retention factors for the sub-group “poultry” can be found in the literature (e.g. chicken, turkey, duck or goose). Some compilers may prefer to us the most specific values and others no. EuroFIR’s recommendation is to use specific values if available.

Table 1: Availability of nutrient retention factors by food group and recommendations for use (vitamins)

First level	Second level	Third level	LanguaL Code	Availability of factor	Comments/Recommendations on Retention Factors
Beverage (non-milk)			A0840	No	Not applicable
	Alcoholic beverage		A0846	No	Not applicable / Industrially processed
		Alcoholic mixed drink	A0851	No	Not applicable / Industrially processed
		Beer or other malt beverage	A0847	No	Not applicable / Industrially processed
		Cider, perry or similar drink	A0848	No	Not applicable / Industrially processed
		Liqueur or spirits	A0850	No	Not applicable / Industrially processed
		Wine, fortified wine or wine-like beverage	A0849	No	Not applicable / Industrially processed
	Juice or nectar		A0841	No	Use factor for *Fruit or fruit product* (A0833)
	Non-alcoholic beverage		A0842	No	Only available for coffee and tea
		Coffe, tea, cocoa	A0845	Yes	Average from tea and coffee
		Soft drink	A0843	No	Not applicable / Industrially processed
		Water	A0844	No	Not applicable / Industrially processed
Egg or egg product			A0790	Yes	General factor, derived from A0792 or A0791
	Egg dish		A0792	No	Use general factor for *Egg or egg product* (A0790)
	Fresh or processed egg		A0791	No	Use general factor for *Egg or egg product* (A0790)
Fat or oil			A0805	Yes	Use when available
	Butter or animal fat		A0808	No	Use general factor for *Fat or Oil* (A0805)
		Butter	A0809	No	Same as above
		Fish oils	A0811	No	Same as above
		Other animal fats	A0810	No	Same as above
	Margarine or lipid of mixed origin		A0807	No	Same as above
	Vegetable fat or oil		A0806	No	Same as above
Fruit or fruit product			A0833	Yes	Use when available / General factor
	Processed fruit product		A0834	Yes	Use for Jam or Marmalade

Table 1:….continued…

First level	Second level	Third level	LanguaL Code	Availability of factor	Comments/Recommendations on Retention Factors
Grain or grain product			A0812	Yes	General factor, group average. Use when no more details are provided.
	Bread		A0817	Yes	Derived from factor for A0813 (Baked)
		Bread product	A0820	No	Same as above
		Leavened bread	A0818	No	Same as above
		Unleavened bread	A0819	No	Same as above
	Breakfast cereal		A0816	No	Use general factor for *Grain or Grain Product* (A0812)
	Fine bakery ware		A0821	No	Use general factor for *Grain or Grain Product* (A0812)
	Flour or starch		A0813	Yes	Use when available
	Pasta		A0813	Yes	Use when available
	Rice or other grain		A0814	Yes	Use when available
	Savoury cereal dish		A0822	Yes	Use if available. Includes dumpling, risotto, pancake, pizza, sandwich, others.
Meat or meat product			A0793	Yes	General factor, group average. Use when no more details are provided.
	Meat analogue		A0800	No	Use factor for *Meat or Meat Product* (A0812)
	Meat dish		A0799	No	Use general factor (A0793)
	Offal		A0796	Yes	Use when available
	Poultry		A0795	Yes	Average factor for chicken, turkey, duck & goose. Individual factors are also available.
	Preserved meat		A0797	No	Use factor for Sausage or similar product (A0798)
	Red meat		A0794	Yes	Average factor for beef, pork, lamb & game. Individual factors are also available
	Sausage or similar product		A0798	Yes	Use when available

Table 1:….continued…

First level	Second level	Third level	LanguaL Code	Availability of factor	Comments/Recommendations on Retention Factors
Milk, milk product or milk substitute			A0778	Yes	Use when available, general factor from whole group
	Cheese		A0784	No	Use general factor (A0784)
		Cured cheese	A0785	No	Same as above
		Processed cheese	A0787	No	Same as above
		Uncured cheese	A0786	No	Same as above
	Fermented milk product		A0783	No	Same as above
	Frozen dairy dessert		A0789	No	Same as above
	Immitation milk products		A0788	No	Same as above
	Milk		A0779	No	Same as above
		Cream	A0782	No	Same as above
		Liquid milk	A0780	No	Same as above
		Processed milk	A0781	No	Same as above
	Prepared food product		A0861	No	Same as above
		Dessert	A0864	No	Same as above
		Dessert sauce	A0863	No	Same as above
		Prepared salad	A0866	No	Same as above
		Sandwich filling	A0867	No	Same as above
		Savoury sauce	A0862	No	Same as above
		Savoury snack	A0868	No	Same as above
		Soup	A0865	No	Same as above
	Spice, condiment or other ingredient		A0853	No	Apply factor according to food source (LanguaL facet B)
		Baking ingredient	A0854	No	Same as above
		Chutney or pickle	A0860	No	Same as above
		Condiment	A0858	No	Same as above
		Dressing mayonnaise	A0859	No	Same as above
		Flavoring or essence	A0855	No	Same as above
		Herb or spice	A0857	No	Same as above
		Miscellaneous food product	A0852	No	Apply factor according to food source (LanguaL facet B)

Table 1:….continued…

First level	Second level	Third level	LanguaL Code	Availability of factor	Comments/Recommendations on Retention Factors
Nut, seed or kernel			A0823	No	Use factor for *Vegetable dish* (A0828)
	Nut or seed product		A0824	No	Use factor for *Vegetable dish* (A0828)
Product for special nutritional use or dietary supplement			A0869	No	Apply factor according to food source (LanguaL facet B)
	Dietary supplement		A0870	No	Same as above
	Food for special nutritional use		A0871	No	Same as above
		Food for infants	A0873	No	Same as above
		Medical food	A0872	No	
Seafood or related product			A0801	Yes	General factor, group average. Use when no more details are provided.
	Fish or related organism		A0802	Yes	Use when available. Average factor for low fat fish and fat fish individual factors are also available
	Seafood dish		A0804	Yes	Use when available.
	Seafood product		A0803	No	Use factor for *Seafood dish* (A0801)
Sugar or sugar product			A0835	No	Only available for Jam or marmalade
	Chocolate or chocolate product		A0839	No	Not applicable / Industrially processed
	Jam or marmalade		A0837	Yes	Use when available
	Non-chocolate confectionery or other sugar product		A0838	No	Not applicable / Industrially processed
	Sugar, honey or syrup		A0836	No	Not applicable / Industrially processed

Table 1:….continued…

Vegetable or vegetable product			A0825	Yes	General factor, group average. Use when no more details are provided
	Pulse or pulse product		A0831	No	Use factor derived from A0832
		Pulse dish	A0832	Yes	Use when available, otherwise use general factor for *Vegetable or Vegetable Product* (A0825)
	Starchy root or potato		A0829	Derived from A830	Averagel factor, derived from A0830 and other potato products
		Potato dish	A0830	Yes	Use when available
	Vegetable (excluding potato)		A0826	No	Use factor derived from A0832
		Vegetable dish	A0828	Yes	Use when available
		Vegetable product	A0827	No	

4.2 Nutrient retention factors and the cooking methods (LanguaL facet G)

There are many different ways to prepare foods at household level. The cooking techniques are characteristic for each country or region and can even vary within individuals. Furthermore, each recipe has its own peculiarities and "secrets". Nevertheless, cooking methods have to be systematically grouped and defined in order to be able do calculations for FCDBs. Several definitions are available in the literature, but for standardisation purposes the LanguaL facet G has been assumed, including the scope notes and comments. Since cooking parameters were still missing, these have been borrowed from those published by Bógnar (2002).

Table 2 present a list of cooking methods, parameters, and recommendations on how to match and select them. The structure of this table has three levels, which correspond to the tree structure also available in the LanguaL indexing software (facet G). The higher the level, the more detailed information about the cooking method is available. A fourth level is sometimes available, but has been group with the third level for practical reasons.

Consistent with the structure of the LanguaL facet G, the following main groups cooking method are available:

- Cooked by dry heat;
- Cooked by moist heat;
- Cooked with fat or oil;
- Cooked by microwave;
- Method of heating container;
- Reheated;
- Scalded or blanched.

In practice, average retention factors are only available for the first 3 groups, namely, "cooked by dry heat", cooked by moist heat" and "cooked with fat or oil". All other cooking methods have been assigned to the best match within these 3 groups.

EuroFIR compilers are asked to follow the recommendations of which factor to use presented in Table 2. If the first recommendation cannot be fulfilled, a second option is given. For example, for "Steamed with pressure" use factor for C*ooked in Steam* (G0021) (first option), otherwise use general factor for *Cooked by Moist Heat (G0012)* (second option).

Table 2. Availability of retention factors by cooking method and recommendations for use

First level	*Second level*	Third & Fourth levels	LanguaL code	Scope/Additional information provided by LanguaL	Parameters: Temp. (°C), Pressure (Mpa), Time (min). (Bógnar, 2002).	Availability of factors	Recommendation
Cooked by dry heat			G0004	*Cooked at moderate to high levels of heat in which no liquid is added and only small amounts of fat may be added to prevent sticking.*	~140-350°C	Yes	Average factor for this group. Use this factor if more details are not provided. Derived from G0005 or G0006.
	Baked or roasted		G0005	*Cooked without moisture, covered or uncovered, in an oven. *ROASTING* usually applies to meats or nuts.*	~160-200°C Food core: <100°C Meat products: 30-240 min Fruits & vegetables: 10-60 min Grain & starchy prod: 20-70 min	Yes (most common)	Use if available, otherwise use general factor for C*ooked by Dry Heat (G0004)*
	Broiled or Grilled		G0006	*Cooked without moisture under or over intense direct heat.*	~200-350°C Food core: <100°C Meat & fish: 4-20 min Poultry: 30-70 min Vegetables, potato, others: 3-15 min	Yes	Use if available, otherwise use general factor for C*ooked by Dry Heat (G0004)*
		Charcoal broiled	G0007	*Cooked without moisture over direct heat from a charcoal fire.*	Same parameters as G0006	No	Use factor for *Broiled or Grilled* (G0006) otherwise use general factor for C*ooked by Dry Heat (G0004)*
	Griddled		G0008	*Cooked on a flat surface at medium heat with only a sufficient amount of fat used to prevent sticking.*	~180-250°C Food core: <100°C Meat & fish: 4-20 min Vegetables, potatoes: 2-15 min	No	Use general factor for C*ooked by Dry Heat (G0004)*
	Popped		G0009	*Cooked by agitating the food over a dry, high heat source, resulting in exploding.*	N.A.	No	Use general factor for C*ooked by Dry Heat (G0004)*
	Toasted		G0010	*Cooked with direct heat until the surface of the food is browned, usually associated with bread or sandwiches.*	N.A.	No	Use general factor for C*ooked by Dry Heat (G0004)*
Cooked by microwave			G0011	*Cooked in a microwave oven.*	Temp.: ~ 100°C Pressure: ~ 0.10 Mpa Time: Depending on food quantity	No	Use general factor for *Cooked by Moist Heat (G0012))*

Table 2....Continued...

First level	*Second level*	Third & Fourth levels	LanguaL code	Scope/Additional information provided by LanguaL	Parameters: Temp. (°C), Pressure (MPa), Time (min) (Bognar, 2002).	Availability of factors	Recommended Retention Factor
Cooked by dry heat			G0012	*Cooked in varying amounts of water, water-based liquid or steam.*	~ 100-125°C ~ 0.10-0.20 Mpa Time: Depending on food	Yes	Average factor for this group. Use this factor if more details are not provided. Derived from G0021 or G0013.
	Cooked in steam		G0021		~ 100-120°C ~ 0.10-0.20 Mpa Time: Depending on food	Yes	Use if available, otherwise use general factor for *cooked by moist heat (G0012)*
		Steamed with pressure	G0022	*Cooked in a pressure cooker.*	Temp.: ~ 102-120°C Pressure: ~ 0.11-0.20 MPa Time: Depending on food	No	Use factor for C*ooked in Steam* (G0021), otherwise used general factor for *Cooked by Moist Heat (G0012)*
		Steamed without pressure	G0023	*Cooked suspended above boiling water.*	Temp.: ~ 100°C Pressure: ~ 0.10 Mpa Time: Depending on food	No	Use factor for C*ooked in Steam* (G0021), otherwise used general factor for *Cooked by Moist Heat (G0012)*
	Cooked in water or water-based liquid		G0013			No	Use general factor for *cooked by moist heat (G0012)*
		Boiled	G0014	*Cooked in boiling water at 212 degrees F. (100°C)*	Temp.: ~ 100°C Pressure: ~ 0.10 Mpa Time: Depending on food	Yes (most common)	Use if available otherwise use general factor for *Cooked by Moist Heat (G0012)*
		Boiled, Drained	G0015	*Cooked in boiling water at 212 degrees F.; water that is not absorbed into the food product is discarded after cooking.*	Same as G0014	Yes	Use if available (if specifically refers to solid part). Otherwise use factor for *Boiled* (G0014) or general factor for *Cooked by Moist Heat (G0012)*
		Boiled, Undrained	G0018	*Cooked in boiling water at 212 degrees F. The water incorporates itself into the product being cooked or is not discarded when cooking is through.*	Same as G0014	Yes	Use if available (if specifically refers to solid part plus liquid or gravy). Otherwise use factor for *Boiled* (G0014) or general factor for *Cooked by Moist Heat (G0012)*
		Braised	G0019	*Browned initially in fat and then tightly covered and cooked over low heat in a small amount of water.*	Frying in pan: 180-200°C, 5-15 min. / Stewing: ~ 100-120°C, 0.10-0.20 Mpa, 10-180 min	Yes (mostly together with stew)	Use if available otherwise use factor for *Stewed* (G0020) or general factor for *Cooked by Moist Heat (G0012)*
		Simmered, poached or stewed	G0020	*Cooked in a moderate amount of liquid at just below the boiling point.*	Temp.: ~ 100-120°C Pressure: ~ 0.10-0.20 MPa Time: Depending on food	Yes (most common)	Use if available otherwise use general factor for *Cooked by Moist Heat (G0012)*
		Steeped	G0036	*Extracting flavour and other components from food sources by immersion in water, usually at near-boiling temperature.*	N.A.	Yes	Use if available otherwise use general factor for *Cooked by Moist Heat (G0012)*

Table 2.....continued....

First level	*Second level*	Third & Fourth levels	LanguaL code	Scope/Additional information provided by LanguaL	Parameters: Temp. (°C), Pressure (MPa), Time (min) (Bognar, 2002).	Availability of factors	Recommendation
Cooked by dry heat			G0024	Synonym = fried	~140-200°C Food core: <100°C Eggs: 2-8 min. Meat & Fish: 4-20 min Vegetables, potatoes, others: 3-15 min	Yes	Average factor for this group. Use this factor if more details are not provided
	Cooked with added fat or oil		G0025	Cooked by adding fat or oil to those foods that do not contain fat or oil that would render during the cooking process.	Same as G0024	No	Use general factor for *Cooked with Fat or Oil (G0024)*
		Cooked in small amount of fat (Sauteed /Stir-fried)	G0026	Cooked with sufficient fat or oil to coat and moisten the food being prepared, but not cooked in enough fat or oil to immerse the food. Use *GRIDDLED* when only enough fat or oil is used to prevent sticking.	~160-200°C Food core: <100°C Eggs: 2-8 min. Meat & Fish: 4-20 min Vegetables, potatoes, others: 3-15 min	Yes (most common)	Use if available otherwise use general factor *Cooked with Fat or Oil (G0024)*
		Deep-fried	G0029	Cooked in hot fat or oil deep enough to immerse the food entirely.	140-200°C Food core: <100°C Meat & Fish: 4-20 min Vegetables, potatoes, others: 3-15 min	Yes	Use if available otherwise use general factor for *Cooked with Fat or Oil (G0024)*
		Shallow-fried	G0035	A chinese cooking technique similar to sauteing in which thick slices or chunks of floured or battered ingredients are slow seared over moderate to low heat.	N.A	No	Use factor for *Cooked with Small Amount of Fat (sauteed/stir-fried)(G0026).* Other wise use factor for *Cooked with Fat or Oil (G0024)*
	Cooked with inherent fat or oil		G0030	Cooked in fat or oil rendered from the food being prepared.	Same as G0024	No	Use factor for *Cooked with Small Amount of Fat (sauteed/stir-fried)(G0026).* Other wise use factor for *Cooked with Fat or Oil (G0024)*

Table 2.....continued....

First level	*Second level*	Third Fourth levels	& LanguaL code	Scope/Additional information provided by LanguaL	Parameters	Availability of factors	Recommendation
Method of heating container			G0032	The method by which heat is transferred to the outside of the cooking container. The most frequently used method of placing the container on an open flame, a hot metal surface or into an oven are not indexed here.	N.A.	No	Use general factor for *Cooked by Moist Heat (G0012))*
	Cooked in container immersed in water or steam		G0031	Used when the food is cooked in a closed container such as a pouch immersed in hot water or steam.	N.A	No	Use general factor for *Cooked by Moist Heat (G0012))*
	Cooked in double boiler		G0033	Cooked in a container that is placed in another container filled with boiling water. See also *Cooked in water bath*.	N.A	No	Use general factor for *Cooked by Moist Heat (G0012))*
	Cooked in water bath		G0034	Cooked in a container that is placed in another container filled with water kept near the boiling point. See also *Cooked in double boiler*	N.A	No	Use general factor for *Cooked by Moist Heat (G0012))*
Reheated			G0037	Reheating is a simple process to bring an already fully cooked product to serving temperature. Do not use for a process that completes the cooking of a partially cooked food.	N.A	No	Use general factor for *Cooked by Moist Heat (G0012)*
	Reheated by boil -in-bag		G0040		N.A	No	Use general factor for *Cooked by Moist Heat (G0012))*
	Reheated by dry heat		G0039		N.A	No	Use general factor for *Cooked by Dry Heat (G0004)*
	Reheated by microwave		G0038		N.A	No	Use general factor for *Cooked by Moist Heat (G0012))*
	Reheated in pan or cooking utensil		G0041		N.A	No	Use general factor for *Cooked by Moist Heat (G0012)*
Scalded or blanched			G0042	A method of precooking food where a liquid is heated to just below the boiling point (180 degrees F.). Often used to retard the spoiling of milk. Also, to plunge food such as fruit or vegetables into boiling water (or to pour boiling water over them) in order to loosen the skin and facilitate peeling.	N.A	No	Use general factor for *Cooked by Moist Heat (G0012)*

5 EUROFIR RECOMMENDED RECIPE CALCULATION METHOD

The report "Harmonisation of recipe calculation procedures" (Reinivuo and Laitinen, 2007) presents a collection and discussion of the various recipe calculation procedures used by the European FCDBs. After evaluating the information available, the EuroFIR Compiler Network has agreed on adopting the following recommendations:

- **Weight yields** should be applied at **recipe level**
- **Nutrient retention factors** should be applied at **ingredient level**.

The recipe calculation procedure adopting these considerations is summarised as follows:

a) Sum weights of raw ingredients in the recipe. Apply yield factor to the total raw weight.

Ingredient	**raw weight g**	**yield factor**	**cooked weight g**
Ingredient A	A g		
Ingredient B	B g		
Ingredient C	C g		
Total weight g	A+B+C (g)	YF	(A+B+C)*(YF) g

Total cooked weight (g) = Total raw weight g * Yield factor

Notice that depending on the recipe and the requirements of the compiler the yield factors applied may related to the edible part or include waste.

b) Search for nutrient content of raw ingredients in 100 g edible part (use data available in FCDBs)

Content of Nutrient X in g per 100 g raw ingredient	
Ingredient A	X_A g/100g
Ingredient B	X_B g/100g
Ingredient C	X_C g/100g

c) Calculate the content of nutrient X per 100 g of cooked weight **before** retention factor is taken into account **(Y)**:

$$\text{Nutrient content per 100 g of cooked weight (Y)} = \text{Nutrient content per 100 g ingredient} * \frac{\text{Raw weight of ingredient (g)}}{\textbf{Total cooked weight} \text{ (g)}}$$

Note that as a result of this calculation the amount of nutrient X in 100 g cooked recipe **without considering the retention factor** is obtained!!

d) Calculate the nutrient content of cooked dish **(Z)**. Apply the corresponding retention factor (RF) for the nutrient X for each ingredient:

Ingredient	nutrient X in g per 100 g of cooked weight **before** retention factor is taken into account **(Y)**	retention factor	nutrient X in g per 100 g of cooked weight **after** retention factor is taken into account **(Z)**
Ingredient A	Y_A g	RF_A	$(Y_A)*(RF_A) = Z_A$
Ingredient B	Y_B g	RF_B	$(Y_B)*(RF_B) = Z_B$
Ingredient C	Y_C g	RF_C	$(Y_C)*(RF_C) = Z_C$
Total nutrient X	$(Y_A + Y_B + Y_C)$ g		$(Z_A+Z_B+Z_C)$ g

Summarising this table, the following equation can be applied:

Corrected nutrient content per 100 g of cooked weight **(Z)** =

$$\text{Nutrient content per 100 g ingredient} * \frac{\text{Raw weight of ingredient (g)}}{\text{Total cooked weight (g)}} * \text{Retention factor}$$

Note that this equation applies for **each ingredient**. The **total content** of nutrient X in the cooked dish is the **sum** of its content in each ingredient **($Z_A+Z_B+Z_C$)**.

6 USE OF NUTRIENT RETENTION FACTORS: SPECIAL CASES IN RECIPE CALCULATION

The use of nutrient retention factors should consider the following special cases:

a) If liquid, gravy, drippings or sauce are considered as part of the dish

Values for the calculation of dishes with or without dripping or sauce are available in the literature (USDA, release 18 and Bógnar, 2002). A careful evaluation of the use of the factors with sauce should be carried out by each compiler. This will depend on their recipes and their own experiences. Selected values are provided in Appendices 1, 2 and 3.

b) If food item is coated breaded (e.g. fried red meat, breaded)

Values for the calculation of dishes with or without coating are available in the literature (USDA, release 18 and Bógnar, 2002). A careful evaluation of the use of the factors with coating should be carried out by each compiler and will depend on their recipes and their own experiences. Nevertheless these factors are only relevant for dishes cooked with added fat or oil, because the coating usually absorbs an important amount of fat. Selected values are provided in Appendix 3.

c) If the preparation steps of a dish include more than one cooking method

Most recipes are prepared in several steps. In fact, not all ingredients are submitted to the same cooking procedure during preparation the preparation of a dish. Some ingredients undergo a previous heat treatment before being mixed with the rest of the ingredients and being cooked again all together, such as:

- fry and boil
- boil, drain and bake
- fry and bake, etc.

If the calculation of the nutrient content in prepared dished starts by considering the nutrient content in the **raw** ingredient , then all the changes that this single ingredient undergoes should be consider in the calculation.

By using retention factors at **ingredient level**, factors can be applied for **each cooking step** and for the **whole dish**.

The preparation of “Swabian ravioli” (German = Maultaschen) is given here as an example.

Description of the food: Quadratic or half-moon, two-layer pasta dough forming a bag usually filled with seasoned ground meat and spinach

Ingredients (edible part):

Filling:
410 g fresh spinach
40 g fresh parsley
130 g onions
160 g white bread
40 g smoked bacon
500 g ground meat (40% beef, 60% pork)
155 g eggs
20 g butter
20 g salt
0,3 g pepper (powder)
0,5 g nutmeg (powder)

Dough
375 g flour
155 g eggs
6 g salt

Cooking procedure:

- **Dough:** mix flour, eggs, water and salt. Knead.
- **Filling:** soak the bread crumbs in water, chop **onions** finely and **cook** them with **margarine** until they are glassy. Mince the **bacon** finely and **fry** it.
- The **spinach** should be washed, **shortly blanched** and chopped.
- Mix the soaked bread with ground meat, eggs, onions and bacon, and season the mixture.
- Knead and roll the dough to get quadratic pieces and fill them with the mixture forming bags (like ravioli).
- Maultaschen can be **cooked** for approximately 15 minutes in salted **boiling water**.

Which nutrient retention factor apply for this recipe?

Before the Maultaschen (or swabian ravioli) are cooked in boiling water, two other heating/cooking procedures occurred:

- Spinach = blanched
- Onions, smoked bacon and butter = fried

!!nutrient losses for these ingredients while preparing the dish have to be considered!!

For selection of retention factors, this example also has to considered that spinach was blanched and drained and onions, smoked bacon and butter where fried and sauce/drippings where incorporated in the filling mixture. The calculations are presented in Table 3

Table 3. Calculation of Vitamin C in Swabian Ravioli (Maultaschen)

Ingredient	Raw weight of ingredient in recipe (g)	Vit C mg/100g (Source: BLS)	Vit C in 100 g cooked recipe, adjusted by weight (Y)	First Retention Factor	Adjusted values after first RF	Factor description	Second Retention Factor (whole dish)	Factor description	Vit C in 100 g cooked recipe, adjusted for RF (Z)
Spinach, fresh	410	48.12	9.8	0.52	5.10	Cooked by moist heat, drained	0.4	Boiled, without liquid (drained)	2.0
Parseley, fresh	40	181.70	3.6	1	3.61	Not applicable, fresh. Use RT =1	0.4	Boiled, without liquid (drained)	1.4
Onions, fresh	130	7.80	0.5	0.85	0.43	Fried, with drippings	0.4	Boiled, without liquid (drained)	0.2
White bread	160	0.00	0.0	1	0.00	Not applicable. Use RT =1	1		0.0
Smoked bacon	40	0.00	0.0	0.8	0.00	Fried, with drippings	1	Boiled, without liquid (drained)	0.0
Ground meat	500	0.00	0.0	1	0.00	Not applicable. Use RT =1	1		0.0
Eggs, chicken	310	0.00	0.0	1	0.00	Not applicable. Use RT =1	1		0.0
Butter	20	1.70	0.017	1	0.017	Fried	1	Boiled, without liquid (drained)	0.0
Salt	26	0.00	0.0	1	0.00	Not applicable. Use RT =1	1		0.0
Pepper	0.3	0.00	0.0	1	0.00	Not applicable. Use RT =1	1		0.0
Nutmeg	0.5	0.00	0.0	1	0.00	Not applicable. Use RT =1	1		0.0
Flour	375	0.00	0.0	1	0.00	Not applicable. Use RT =1	1		0.0
								Sum of Vitamin C, mg/ 100 g whole dish = 3.7	

Note that the following parameter were used: Yield factor= 1; Cooked weight, whole dish = 2011.8 g ; Database used: BLS

7 FUTURE CHALLENGES

The present proposal aims at establishing recommendations for the use and selection of nutrient retention factors by providing systematic rules. The EuroFIR compilers should be aware that these recommendations are based on the experience accumulated at the Federal Research Centre for Nutrition and Food (BfEL) in the past years. For this reason, the work of Bógnar published in 2002 was used as a guide for the elaboration of this document.

All these recommendations need to be further validated. Compilers are encouraged to continue using these recommendations and to further provide the authors with their experiences, in order to continue improving this work.

8 REFERENCES

Bell, S. (2006). Report on Nutrient Losses and Gains Factors used in European Food Composition Databases. WP 1.5 Standards Development, EuroFIR, http://www.eurofir.net.

Bergström, L. (1994). Nutrient losses and gains in the preparation of foods. Uppsala, Livsmedelsverket.

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). Karlsruhe, BFE:7-11, 41-43, 95-97.

Bognár, A. and J. Piekarski (2000). "Guidelines for recipe information and calculation of nutrient composition of prepared foods (dishes)." J Food Comp Anal 13: 391-410.

Food Standards Agency (2002). McCance and Widdowson's: The Composition of Foods.Cambridge, Royal Society of Chemistry.

Reinivuo; H and Laitinen, K. (2007). Proposal for the harmonisation of recipe calculation procedures. WP 2.2 (D2.2.12/M2.2.4). http://www.eurofir.net

APPENDIX 1. Average Nutrient Retention Factors by Food Group –Cooked by Dry Heat

To be added

APPENDIX 2. Average Nutrient Retention Factors by Food Group –Cooked by Moist Heat

EuroFir Food Classification		LanguaL Code			LanguaL Code	Vit A	Car	Vit B1	Vit C	Source	Comments
		Facet A	Other relevant facets	Cooking method	Facet G					1) Bógnar, 2002 2) Danish Institute for Food and Veterinary, 2006 3) USDA, Release 5, 2003 4) McCance and Widdowson's, 2004	**Most factors are from Bógnar, when values are not found next priority is McCance& Widowson's, then USDA, then others**
Coffe, tea, cocoa		A0845		steeped	G0036						**Average**
	Coffee	A0846	B1305	steeped	G0036	-	-	100	90	1	Coffe, Infusion with boiling water (Bógnar, 2002) = Steep (LanguaL)
	Tea	A0847	B1623	steeped	G0036	-	-	100	90		Tea, Infusion with boiling water (Bógnar, 2002) = Steep (LanguaL)
Egg or egg product		A0790		Boiled	G0014	100	100	80	80	1	General factor for food group
Fat or oil		A0805		Boiled	G0014	85	85	100	100	2	General factor for food group
Fruit or fruit product		A0833		**Cooked by moist heat**	**G0012**	**75**	**75**	**73**	**55**	1	General factor for food group and cooking method
				Boiled	G0014	75	75	65	40		General factor for food group
				Stewed	G0020	75	75	80	70		General factor for food group
Fruit or fruit product, with		A0833		Boiled	G0014	75	75	80	70	1	General factor for food group, with liquid, syrup
	Processed fruit product	A0834, A0837		Jam, Jelly		90	90	100	80	1	Jam or Jelly or Jam or Marmalade
Grain or grain product		A0812		**Cooked by moist heat**	**G0012**	**93**	**93**	**68**	**72**		General factor for food group and cooking method
				Boiled, steamed	G0014, G0021	90	90	60	73		General factor for food group
				Stewed	G0020	95	95	75	70		General factor for food group
	Flour or starch	A0813		Boiled, steamed	G0014, G0021	90	90	80	80	3	steamed

	Pasta	A0815		Boiled	G0014	90	90	85	70	1	Noodles, white flour, solid part (drained)
	Rice or other grain, whole	A0814	C0133	**Cooked by moist heat**	**G0012**	**93**	**93**	**63**	**70**		General factor for cooking method
				Boiled	G0014	90	90	50	70	1	Cereal grains and grain seeds/ whole, edible part, boil /whole, with sauce, stew
				Stewed	G0020	95	95	75	70	1	
	Rice or other grain, polished	A0814	C0134	**Cooked by moist heat**	**G0012**	**93**	**93**	**63**	**70**		General factor for cooking method
				Boiled	G0014	90	90	50	70	1	Cereal grains and grain seeds/polished, edible part, boil /polished, with sauce, boiled
				Stewed	G0020	95	95	75	70	1	Cereal grains and grain seeds/polished, edible part, boil /polished, with sauce, stew
Meat or meat product		A0793		**Cooked by moist heat**	G0012	76	76	61	71		General factor for food group and cooking method
				Boiled, steamed	G0014, G0021	75	75	58	70		General factor for food group
				stewed, braised	G0020, G0019	77	77	63	73		General factor for food group
Meat or meat product, with		A0793	K0034	**Cooked by moist heat**	**G0012**	**88**	**88**	**77**	**79**		food group and cooking method, with sauce
				Boiled, steamed	G0014, G0021	88	88	75	78		General factor for food group
				stewed, braised	G0020, G0019	88	88	79	80		General factor for food group
	Offal	A0796		**Cooked by moist heat**	**G0012**	**80**	**80**	**78**	**73**		General factor for cooking method
				Boiled, steamed	G0014, G0021	80	80	70	70	1	Offal based dishes, >80°C (liver, kidney, ung, tongue, blood, brain)
				stewed, braised	G0020, G0019	80	80	85	75	1	Offal based dishes, >80°C (liver, kidney, ung, tongue, blood, brain)

Offal, with sauce	A0796	K0034	**Cooked by moist heat**	**G0012**	**90**	**90**	**85**	**78**		General factor for cooking method
			Boiled, steamed	G0014, G0021	90	90	80	75	1	Offal based dishes, >80°C, with sauce (liver, kidney, ung, tongue, blood, brain)
			stewed, braised	G0020, G0019	90	90	90	80	1	Offal based dishes, >80°C, with sauce (liver, kidney, ung, tongue, blood, brain)
Poultry	A0795		**Cooked by moist heat**	**G0012**	**57**	**57**	**50**	**-**		Average, general factor for food group and cooking method
			Boiled, steamed	**G0014, G0021**	**55**	**55**	**50**	**-**		General factor for food group, boiled or steamed : Average chicken, turkey & duck
			stewed, braised	**G0020**	**58**	**58**	**50**	**-**		General factor for food group, stewed or braised : Average chicken, turkey & duck
Poultry, with sauce	A0795	K0034	**Cooked by moist heat**	**G0012**	**80**	**80**	**68**	**-**		Average, general factor for food group and cooking method, with sauce
			Boiled, steamed	**G0014, G0021**	**80**	**80**	**67**	**80**		General factor for food group, boiled or steamed : Average chicken, turkey & duck
			stewed, braised	**G0020**	**80**	**80**	**70**	**80**		General factor for food group, stewed or braised : Average chicken, turkey & duck
Chicken	A0795	B1457	**Cooked by moist heat**	**G0012**	**58**	**58**	**55**	**-**		General factor for cooking method
			Boiled, steamed	G0014, G0021	55	55	55	-	1	Poultry-based dishes, Chicken, core temperature >80°C
			stewed, braised	G0020, G0019	60	60	55	-		

			stewed, braised	**G0020**	**80**	**80**	**67**	**78**			General factor for food group, with sauce
Beef	A0794	B1161	**Cooked by moist heat**	**G0012**	**75**	**75**	**43**	**-**			General factor for cooking method
			Boiled, steamed	G0014, G0021	75	75	40	-		1	Veal and beef, well done, >75°C
			stewed, braised	G0020, G0019	75	75	45	-			
Beef, with sauce	A0794	B1161, K0034	Boiled, steamed, stewed, braised = **Cooked by moist heat**	G0014, G0021, G0020, G0012, G0019	80	80	60	75		1	Veal and beef, well done, >75°C
Pork	A0794	B1136	**Cooked by moist heat**	**G0012**	**78**	**78**	**38**	**-**			General factor for cooking method
			Boiled, steamed	G0014, G0021	75	75	30	-		1	Pork, core temp. >75°C
			stewed, braised	G0020, G0019	80	80	45	-			
Pork, with sauce	A0794	B1136, K0034	**Cooked by moist heat**	**G0012**	**80**	**80**	**65**	**80**			General factor for cooking method
			Boiled, steamed	G0014, G0021	80	80	60	80		1	Pork, core temp. >75°C
			stewed, braised	G0020, G0019	80	80	70	80			
Lamb, mutton & game	A0794	B1183, B1669 or B1134	**Cooked by moist heat**	**G0012**	**80**	**80**	**40**	**-**			General factor for cooking method
			Boiled, steamed	G0014, G0021	80	80	40	-		1	lamb, mutton, game, >75°C
			stewed, braised	G0020, G0019	80	80	40	-			
Lamb, mutton & game, with sauce	A0794	B1183, B1669 or B1134, K0034	**Cooked by moist heat**	**G0012**	**80**	**80**	**70**	**80**			General factor for cooking method
			Boiled, steamed	G0014, G0021	80	80	70	80		1	lamb, mutton, game, wth sauce >75°C
			stewed, braised	G0020, G0019	80	80	70	80			
Sausage or similar product	A0798		Boiled, steamed, stewed = **Cooked by moist heat**	G0014, G0021, G0020, G0012	90	90	75	70		1	minced meat and meat products, >75°C

	Sausage or similar product, with sauce	A0798	K0034	Boiled, steamed, stewed, braised = **Cooked by moist heat**	G0014, G0021, G0020, G0012	100	100	90	80	1	minced meat and meat products, with sauce, >75°C
Milk, milk product or milk substitute		A0778		**Cooked by moist heat**	**G0012**	**100**	**100**	**85**	**70**		General factor for cooking method
										1	Milk and mil product based dishes (blanc mange, custard, sheese soufflé)
				Boiled		100	100	90	70		
				stewed	G0020	100	100	80	70		
Seafood or related product		A0801		Boiled, steamed, stewed = **Cooked by moist heat**	G0014, G0021, G0020, G0012	90	90	82			General factor for food group
Seafood or related product, with sauce		A0801	K0034	Boiled, steamed, stewed = **Cooked by moist heat**	G0014, G0021, G0020, G0012	83	83	75			General factor for food group, with sauce
	Low fat fish	A0802	Z0183	Boiled, steamed, stewed = **Cooked by moist heat**	G0014, G0021, G0020, G0012	90	90	75	80	1	Low fat fish, fat content < 5%
	Low fat fish, with sauce	A0802	Z0183, K0034	Boiled, steamed, stewed = **Cooked by moist heat**	G0014, G0021, G0020, G0012	90	90	75	85	1	Low fat fish, fat content < 5%
	Fat fish	A0802	Z0182	Boiled, steamed, stewed = **Cooked by moist heat**	G0014, G0021, G0020, G0012	70	70	75	80	1	Fat fish, fat content >5%
	Fat fish, with sauce	A0802	Z0182, K0034	Boiled, steamed, stewed = **Cooked by moist heat**	G0014, G0021, G0020, G0012	90	90	85	85	1	Fat fish, fat content >5%
	Seafood dish	A0804		Boiled, steamed, stewed = **Cooked by moist heat**	G0014, G0021, G0020, G0012	90	90	75	70	1	crab, mussels, squid
	Seafood dish, with sauce	A0804	K0034	Boiled, steamed, stewed = **Cooked by moist heat**	G0014, G0021, G0020, G0012	90	90	85	85	1	crab, mussels, squid
Vegetable or vegetable product		A0825		**Cooked by moist heat**	**G0012**	**-**	**96**	**80**	**70**		Average, general factor for food group and cooking method

			Boiled	G0014	-	96	70	61		General factor for food group
			Steam	G0020	-	96	83	76		General factor for food group
			Stewed	G0021	-	96	87	75		General factor for food group
Pulse dish	A0832		**Cooked by moist heat**	**G0012**		**100**	**73**	**60**		Average, general factor for food group and cooking method
			Boiled	G0014	-	100	65	60	1	Boiled: Legume based dishes, cooked in soaking water / without soaking water (values are the same), drained; Stewed, braised=total dish
			Stewed	G0021	-	100	80	60		
Starchy root or potato	A0829		**Cooked by moist heat**	**G0012**		**97**	**84**	**79**		Average, general factor for food group and cooking method
			Boiled	**G0014**	**-**	**95**	**78**	**70**		Average from potato dish and potato products
			Steam	**G0020**	**-**	**100**	**85**	**80**		Average from potato dish and potato products
			Stewed	**G0021**	**-**	**95**	**90**	**88**		Average from potato dish and potato products
Potato dish	A0830		**Cooked by moist heat**	**G0012**		**93**	**83**	**78**		General factor for cooking method
			Boiled	G0014	-	90	75	70	1	Potato raw. Boiled: edible part, without peel ; Stewed: total dish
			Steam	G0020	-	100	85	80		
			Stewed	G0021	-	90	90	85		
Potato products	A0830	E0119	**Cooked by moist heat**	**G0012**		**100**	**85**	**80**		General factor for cooking method
			Boiled	G0014	-	100	80	70	1	Potato products. Boiled: solid part; Stewed: total dish, including liquid
			Stewed	G0021	-	100	90	90		

Vegetable dish	A0828		**Cooked by moist heat**	**G0012**		**93**	**79**	**67**		Average, general factor for food group and cooking method
									1	Average from root, tuber, bulb vegetables, steam, flower, fruit corn and seeds, mushrooms and leafy vegetables
			Boiled	**G0014**	**-**	**93**	**66**	**53**		
			Steamed	**G0020**	**-**	**93**	**80**	**71**		
			Stewed	**G0021**	**-**	**93**	**90**	**76**		
Root, tuber and bulb vegetables	A0828	B1018	**Cooked by moist heat**	**G0012**		**90**	**80**	**68**		General factor for cooking method
									1	Boiled and Steamed: Vegetable, edible part; Stewed: Total dish
			Boiled	G0014	-	90	70	40		
			Steamed	G0020	-	90	80	80		
			Stewed	G0021	-	90	90	85		
Steam, flower, fruit, corn, seed	A0828	B1036, B1006, B1005, B1232	**Cooked by moist heat**	**G0012**		**90**	**78**	**73**		General factor for cooking method
									1	Boiled and Steamed: Vegetable, edible part; Stewed: Total dish
			Boiled	G0014	-	90	65	65		
			Steamed	G0020	-	90	80	75		
			Stewed	G0021	-	90	90	80		
Mushroom	A0828	B1467	**Cooked by moist heat**	**G0012**		**100**	**78**	**73**		General factor for cooking method Mushrooms based dishes.
									1	Boiled and Steam: solid part; Stewed: whole dish
			Boiled	G0014	-	100	65	65		
			Steamed	G0020	-	100	80	75		
			Stewed	G0021	-	100	90	80		
Leafy vegetables	A0828	B1566	**Cooked by moist heat**	**G0012**		**90**	**78**	**52**		General factor for cooking method
									1	Red cabbage, white cabbage, spinach
			Boiled	G0014	-	90	65	40		
			Steamed	G0020	-	90	80	55		
			Stewed	G0021	-	90	90	60		

APPENDIX 3. Average Nutrient Retention Factors by Food Group –Cooked with Fat or Oil

To be added