UNIVERSITEIT GENT

FACULTEIT WETENSCHAPPEN

MELiSSA Food Characterization: phase 1

Technical note: 98.3.33

Management of the accumulated food data (and revisions by UBP)

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reference/*réference*	Contract number 22070/08/NL/JC
issue/*édition*	1
revision/*révision*	0
date of issue/*date d'édition*	06/10/2010
status/*état*	Final
Document type/*type de document*	Technical Note
Distribution/*distribution*	

A P P R O V A L

Title *titre*	Management of the accumulated food data	issue 1 *issue*	revision 0 *revision*

author *auteur*	Serge Pieters (Institut Paul Lambin)	date June 2010 *date*

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C H A N G E   L O G

reason for change /*raison du changement*	issue/*issue*	revision/*revision*	date/*date*

C H A N G E   R E C O R D

Issue: 1 Revision: 0

reason for change/*raison du changement*	page(s)/*page(s)*	paragraph(s)/*paragraph(s)*

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List of abbreviations

ANC	Apports Nutritionnels Conseillés (~ Nutritional requirements)
CHO	Carbohydrates
ESM	Equivalent System Mass
EuroFIR	European Food Information Resource
EVA	Extravehicular Activities
INFOODS	International Network of Food Data Systems
IPL	Institut Paul Lambin
MJ	Mega Joule (1 MJ is equal to 238 kcal)
Nd	Not determined
NLG	Nutrient losses and gains
PAL	Physical Activity Level
SI	International System of Units
UBP	University Blaise Pascal
WHO	World Health Organization

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.

MELiSSA food database definitions (to be adapted in relation with EuroFIR)

- **ingredient**, without preliminary transformations. The tomato belongs to this category, it can be consumed just after being harvested.
- **Stabilized ingredients**: they are obtained from fresh plants after a step of transformation. As an example, corn grains can be obtained by threshing.
- **Produced ingredients**: they are obtained from stabilized ingredients. To take again the example of corn, the corn grains can be ground in flour that is a produced ingredient.
- **Additional components**: they are all the ingredients not produced by the MELiSSA loop and are thus of terrestrial origin. The chocolate belongs to this category.
- **Unused ingredients**: It gathers all the ingredients produced by a recipe but not used in the final dish. For example a recipe needs the yellow part of an egg, while keeping the white part for a later use. The white egg is then considered as an unused ingredient.

1 Introduction

University Blaise Pascal (UBP) has developed a specific Melissa software. The aim is to store all information in a large database. UBP conceived a "food management" system in order to match the food production capability of the Life Support System with the needs of the crew. A specific part is related to nutritional information.

The aim of this TN, is to check all possibilities related to the development of a well balanced Melissa menu. In this case, we have to analyze the software in detail from the nutritional requirements for astronaut for long space journeys, to the elaboration of Melissa recipes and integration in a specific Melissa Menu.

IPL drafted this TN, then it was sent for evaluation to UBP. This document served as a basis for a teleconference between IPL and UBP . After this telecon, UBP compiled and prioritized a list of changes or improvements that they can add to the software.
Thus, this document illustrates the improvements to realize in accordance with IPL expectations. The actual changes UBP proposes to implement can be found in the framed parts of the text.

Important note regarding the UBP frames in the text below:

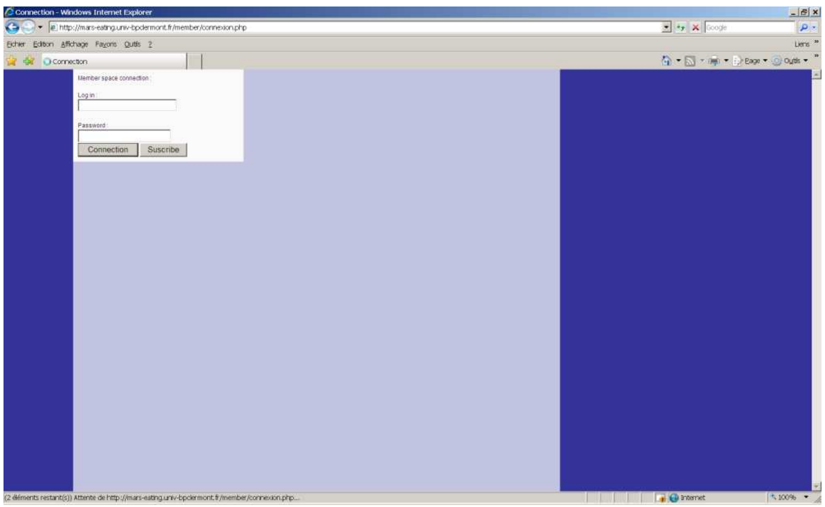
- *Critical revisions must be considered in priority.*
- *Minor revisions can in principle be handled without important changes in the database scheme and in the Web interface.*
- *Major revisions may require a complete reconstruction of the database and of the interface.*

➔ *Critical and minor revisions should be taken in account as soon as possible.*

2 Welcome screen

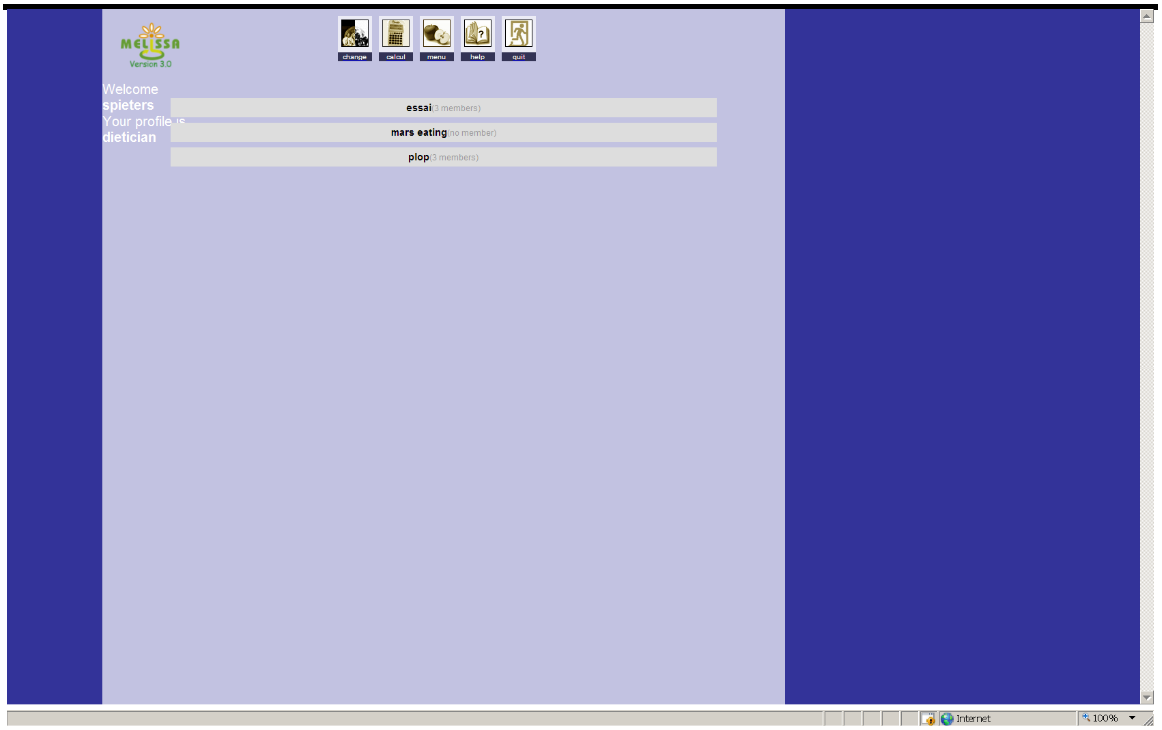
All tests were performed with a PC equipped with Windows XP SP3 and Internet Explorer 7.0 or Mozilla Firefox
Level of Login: Nutritionist

2.1.1 Login screen



Priorities
1. Establish a specification with different levels of security (e.g. visitor, dietician-nutritionist, Agricultural Engineer, Engineer processing ...)
2. Add a traceability system for all users in order to track changes
3. Add for each change the author code and date.

2.1.2 Screen 1



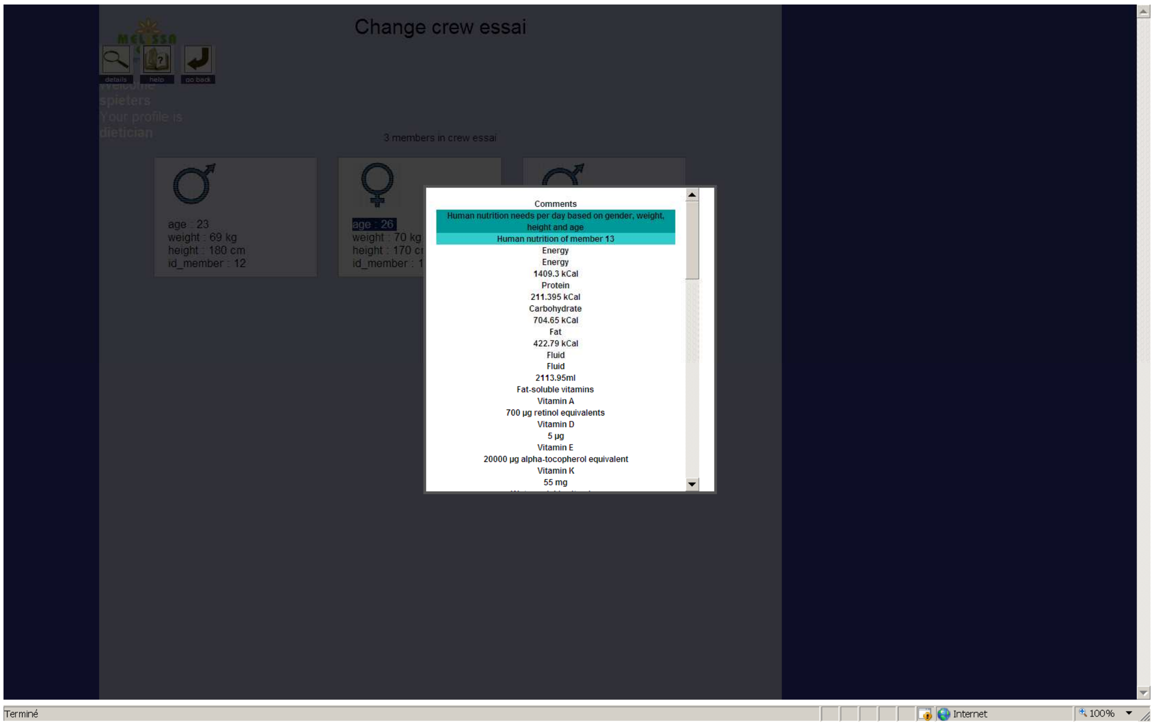
Remarks:
As a dietician, it should be possible to manage (add, delete) crews

Proposals:
1. Add’ or ‘delete’ options should included
2. This program should have two or three different interfaces: an interface for end-users such as astronauts, one for scientists and technicians who have to feed information into the database or use different resources in the database.

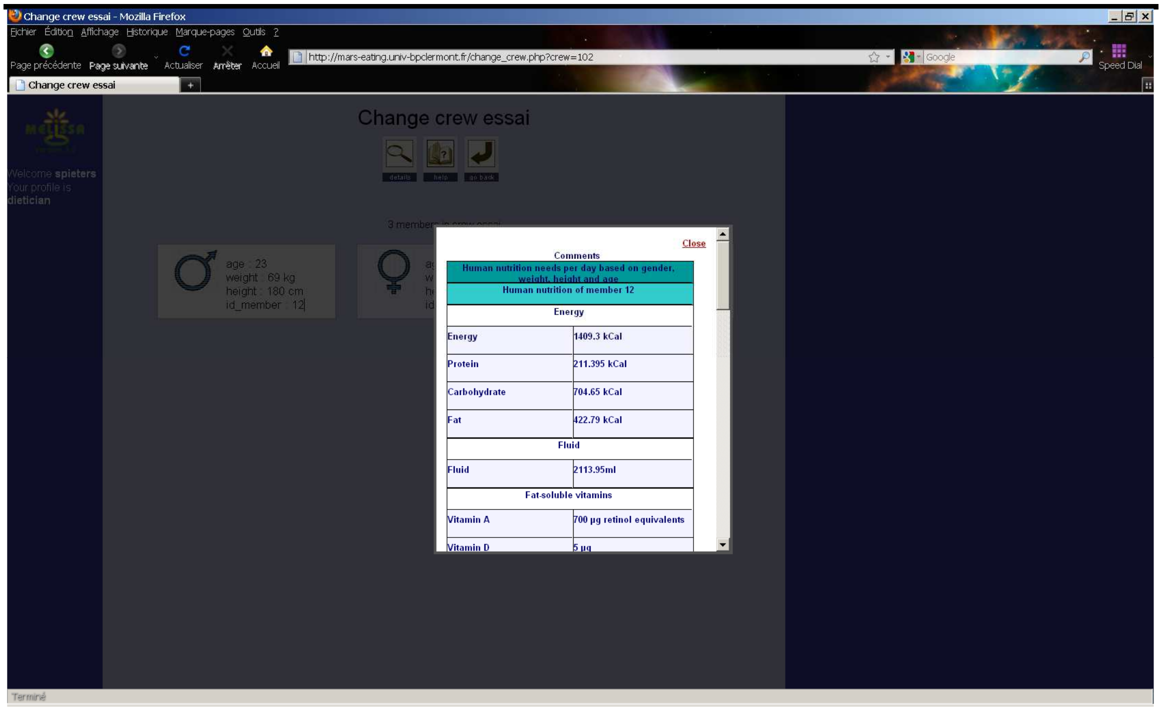
2.1.3 *Screen : change crew*

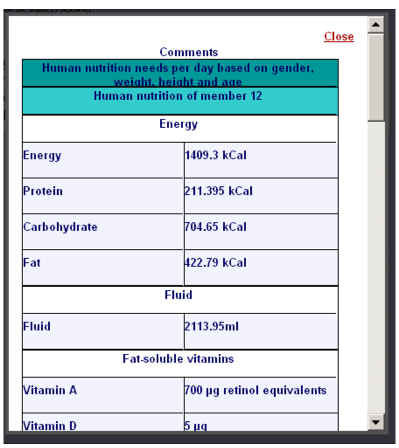
Remarks:
As a dietician, it should be possible to manage (add, delete) crew members. Although the exact number is currently not yet fully defined, each crew has to consist of minimum 1 and maximum 10 people.

2.1.4 Screen 3



This screenshot was obtained with Internet Explorer 7. But with Mozilla 3.6.3. I obtain the following graph:





Proposals:

1. IPL proposes to amend the energy needs for special occasions. A module needs to be added that can calculate the nutritional needs of astronauts based on their physical activities during the day. This module should use the model to estimate the physical activity level (PAL) with specific criteria for astronauts (data to complete later).

E.g. ANC adapted for the French population and table requirements (Mars and Moon) (see Table 1)

2. Due to the difference in gravity, the length of the journey, different irradiation exposure and impact on nutritional status, , two different tables should be provided for Mars and the Moon activities

Table 1 : physical activity level

Energy expenditure			
Category	PAL *	Activities	Period (h)
A	1.0	Sleep and nap, bed rest.	
B	1.5	In sitting position: rest, TV, computer, office work, meal	
C.	2.2	In standing position: toilet, small movements in the station, kitchen, housekeeping, laboratory work, driving gear	
D	3.0	Professional Manual Activities, standing, moderate (chemical industry, machine tools ,...)	
E	3.5	Professional activities of high intensity (repair, ...)	
F	5	Sport, intense professional activities (EVAs)	

* The abbreviation PAL stands for Physical Activity Level. This is a way to express daily physical activity in a number. This number is defined as a multiple of Basal Metabolic Rate, which is the amount of energy consumed during sleeping. The PAL factor can be used to compute the amount of calories one must eat.

Remarks:

1. By adding the amount of energy supplied by proteins, fats and carbohydrates, the sum does not match the total energy.
Total Energy 1409.3 kcal
Protein = 211.395 kcal
+ Carbohydrates: 704.65 kcal
+ Fat 422.79 kcal
Total: 1338.835 kcal a difference of more than 70 kcal

2. The unit for energy according to the International System of Units (SI) is: Energy MJ (kcal) (1 MJ = 238 kcal)
Annex 2 shows the list of nutrients to include in the MELiSSA food database based on INFOODS standards and including their units and decimal points.

3. At this time if we select different crew members, the energy recommendations remain the same, in spite of different anthropometric criteria.

Priorities:

1. Add a module for the management of dietary recommendations taking into account: gender, age, the specific and/or global needs of living space.
Thus, it should be possible to modify the requirements for each astronaut according to specific parameters,

2. Include in the database dietary recommendations set for a mission to the moon to Mars (annex 1)

3; Integrate a data management module with anthropometric and biological information.
It seems important to maintain a history of anthropometric data (annex 3).

UBP propositions 1 : Interface crew

UBP propositions

Interface crew

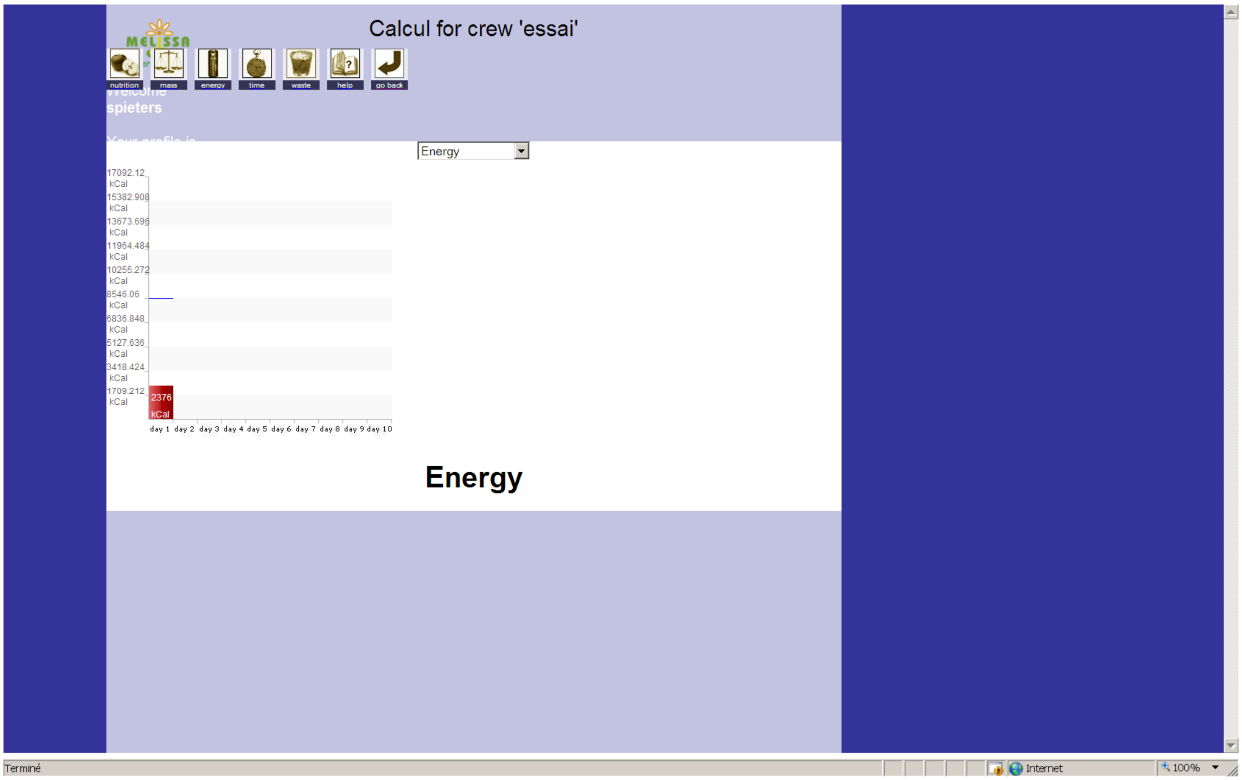
Critical revision:
1. Dietitians should be able to change teams. More generally the permission table for the users should be changed.
2. Whatever the member, the calculation of his nutritional needs are always the same. Syntax error must be found.

Minor revision:
1. The position of critical amino acids must be clarified. To correct this error, we refer to the report of Bernal G. 2009.
2. TN 98.3.33 presents tables for nutritional needs on the Moon and Mars; they should be integrated into the database like all other data validated by IPL (Institut Paul Lambin).

Major revision
1. In long term vision, the nutritional needs should be able to change according to the astronaut's activity. An approach for this problem can be found in TN 83.1 (Poughon, 2007).
2. It would be important to give a direct access to the WHO equation and to authorize modifications by dietitians.

3 Calculations

3.1.1 Screen : calculation for crew energy



Remarks / Proposal

1. I propose to collect all nutritional information per astronaut in a single page and to highlight the elements that pose problems. By clicking on the histogram, it should be possible to bring out more information. These elements must be represented in relation to 100% of estimated nutritional requirements.

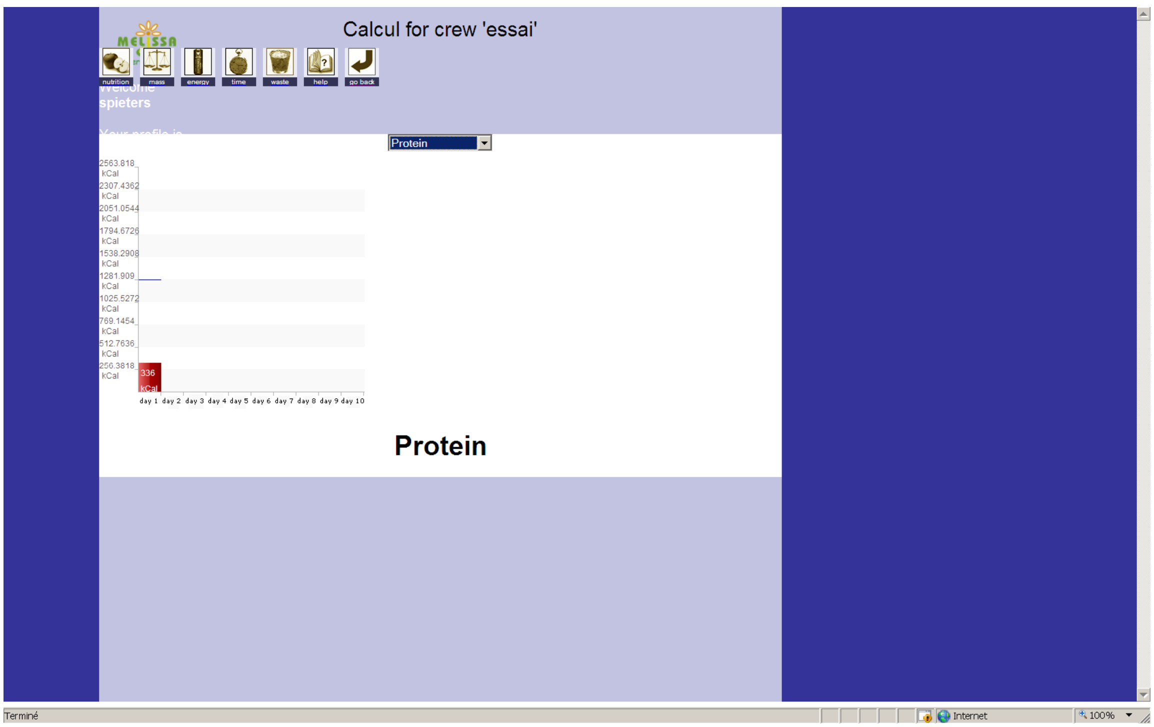
2. As a dietitian-nutritionist, it is essential to print a summary of all nutrient intakes compared with the overall recommendations and the nutritional table of all foods that make up the menu.

3. It is important to have a quick overview per astronaut or team, per day or per 28 days period (length of a Melissa menu)

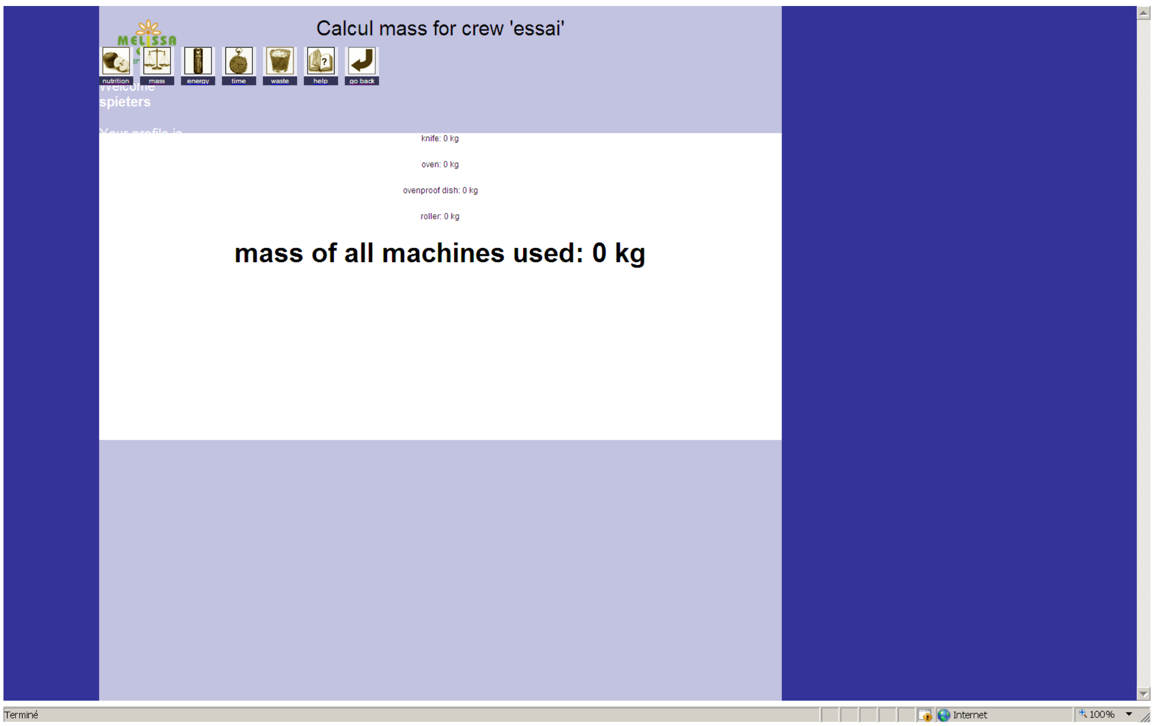
4. In case of inadequate nutrition, the computer must be able to provide a dietary supplement, taking into account stock management. E.g. an astronaut did not cover his magnesium requirements at the end of the day; the computer will check the stock of available foods and

their potential magnesium content; the next day the computer will advise the astronaut to take a ration of dried fruit.
In case of excess of a certain element, the computer will propose to adapt the quantities of this element during the following meal(s).
In both cases a procedure must be defined to determine an acceptable range between intakes and recommendations. A full report must be sent to nutrition team on the ground.
Remarks: This proposal implies that the MELiSSA Food Database includes a stock management module

3.1.2 Screen : calculation for crew

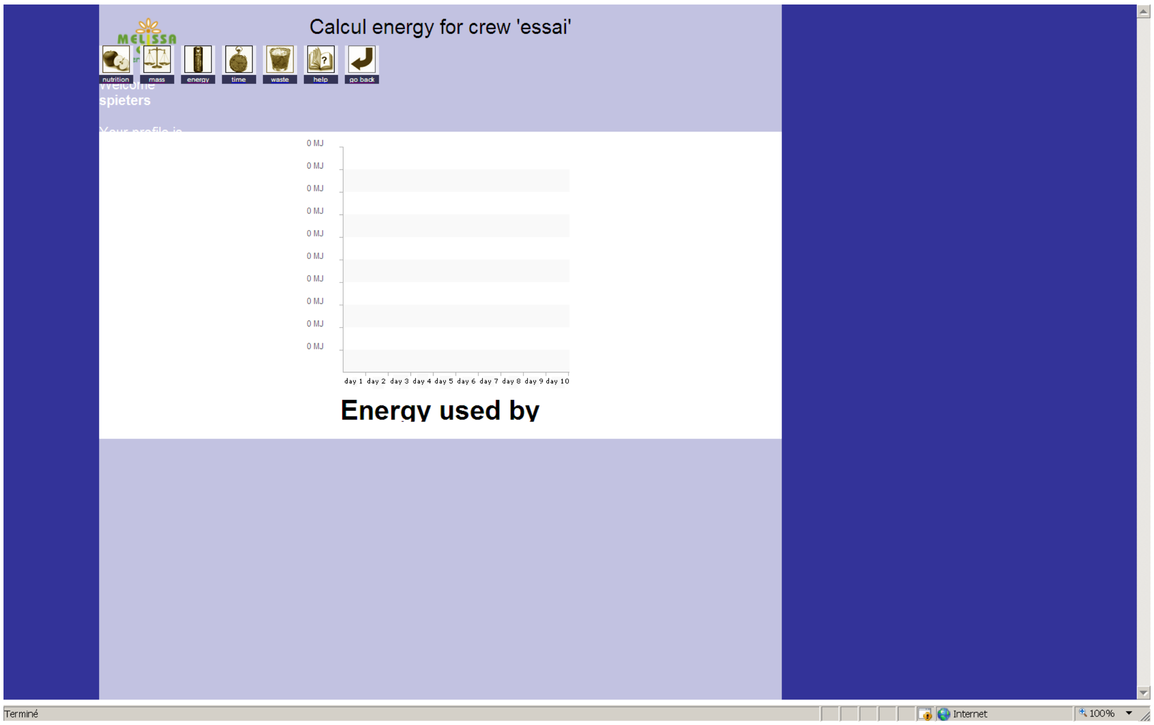


3.1.3 *Screen : calculation of mass of machines needed for crew*



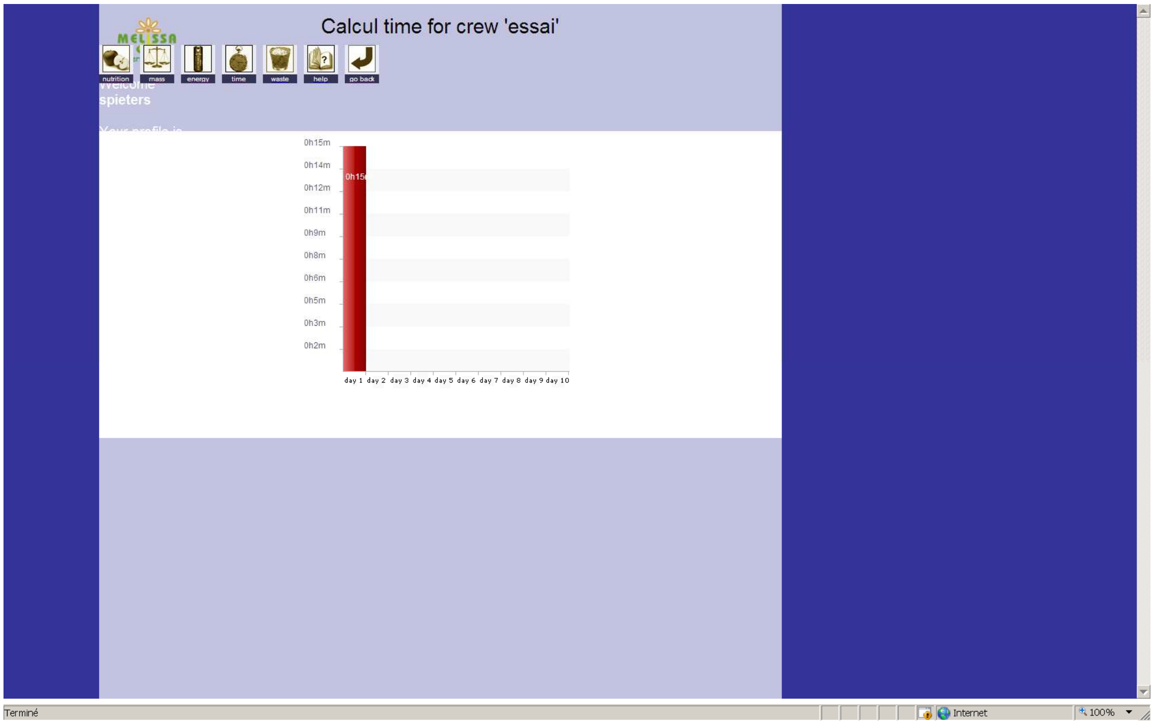
How will you do the sum if you use twice the same oven ?

3.1.4 *Screen : calculation for energy used by the crew*



This screen has to be analyzed by Erich Windhab leader of MFC2 Food Processing Working Group.

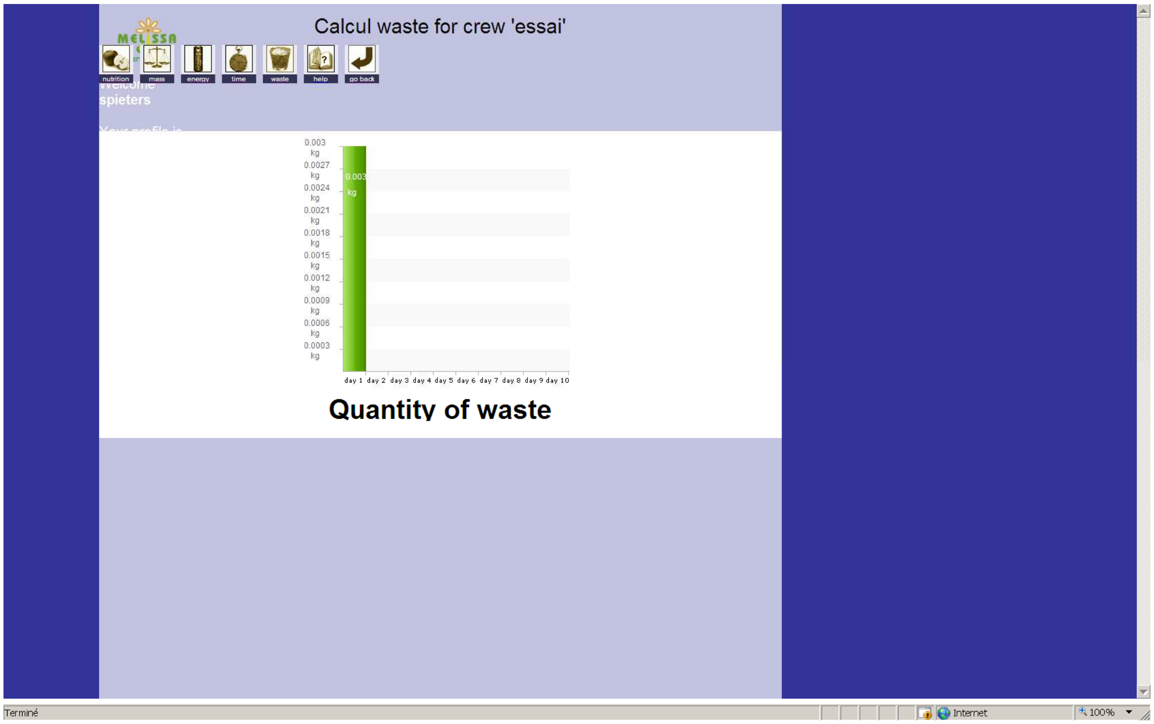
3.1.5 Screen: calculation of crew time



To define : preparation time, cooking time, waiting time, ….

This screen has to be analyzed by Erich Windhab leader of the MFC2 Food Processing Working Group.

3.1.6 Screen : calculation of the quantity of crew waste



To define : black water, grey water, yellow water, usable waste, unusable waste

This screen has to be analyzed by Erich Windhab leader of the MFC2 Food Processing Working Group.

UBP propositions 2 : Interface calcul

UBP propositions

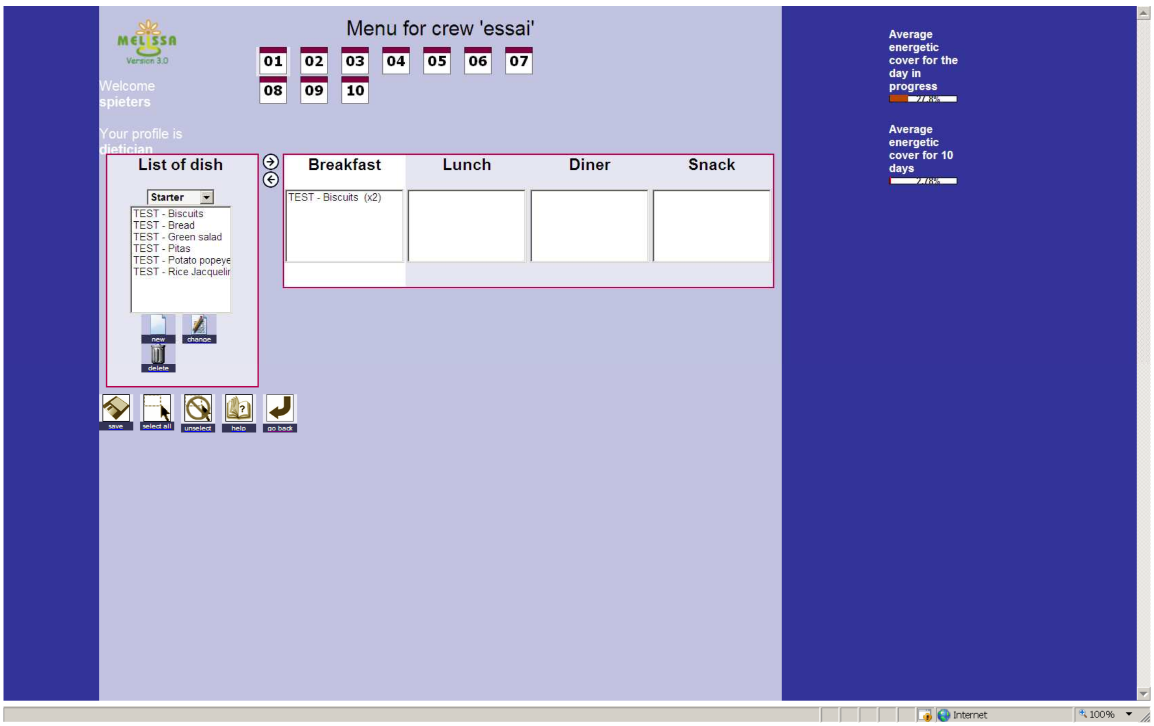
Interface calcul

Critical revision:
It would be much more accurate to define a tolerance threshold for major nutrient values (Loison S, 2010). Several graphics should be put on a single page. One page should summarize the graphics for the major nutrients. Another one should display graphics for nutrients with critical values (i.e. 25% out of the boundary minimal/maximal recommended values for example). An alarm icon can also be used.

Minor revisions
1. In general there are too much significant digits on the diagrams or wrong units; it might be better to express the units in percentages. In addition, it should be indicated that 100% = X g per day.
2. In the nutrition tab, the dietary amount of fluoride, chromium, vitamin D and B12 are missing. (Bernal G., 2009)
3. For the waste tab, the colors are reversed (red and not green).

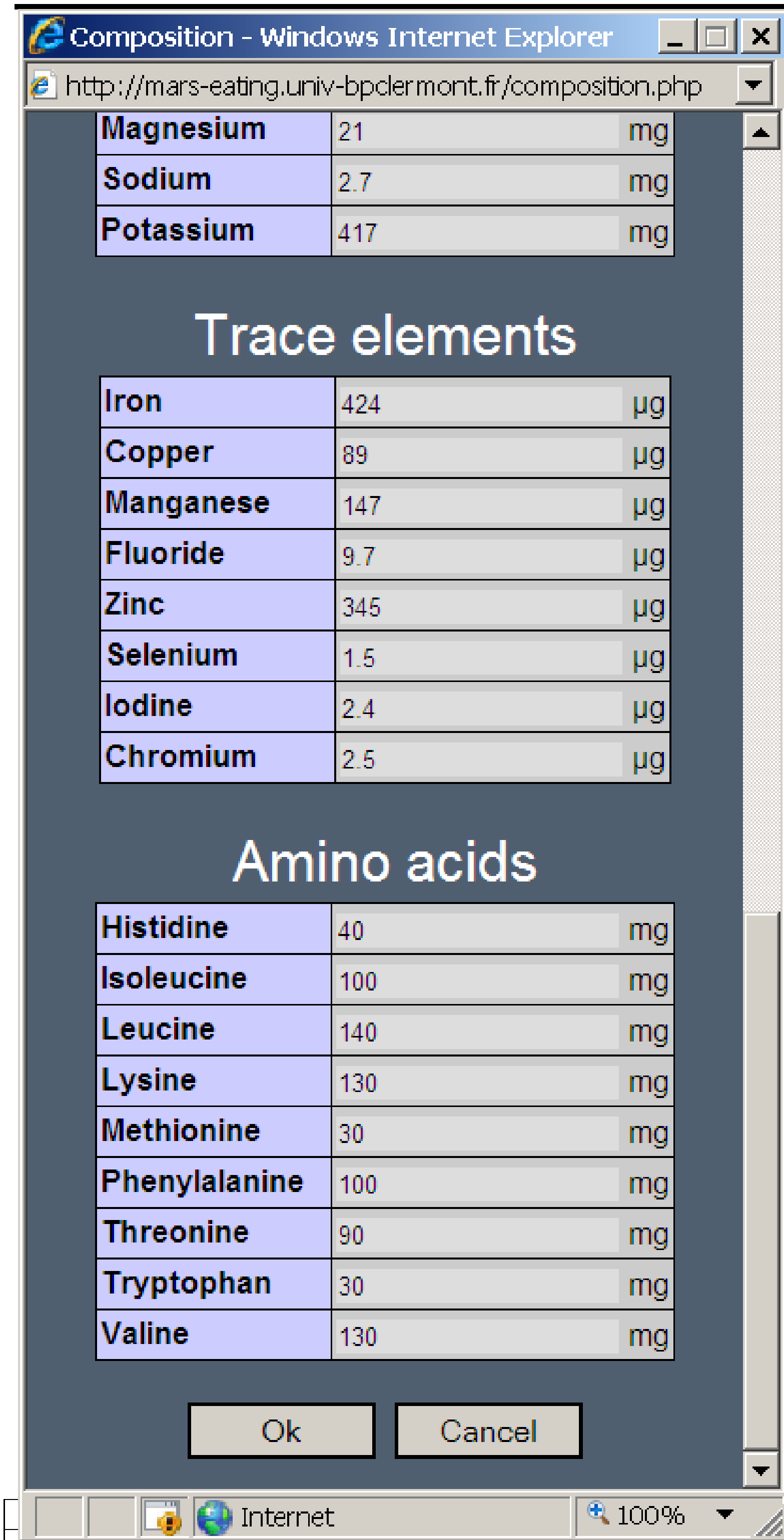
Major revisions
1. When a threshold (max or min) for a specific nutrient is reached, the computer should be able to adjust the quantities of this nutrient for the following meals.
2. The time was defined as “preparation time” and “labour time” in each recipe. Time increased with portion’s number (1 recipe for 6 versus a large amount to stock) but correlation was not easy to describe. Futher discussion on this subject will be under consideration.

4 Menu



Proposals:

1. Include a timetable to get an overview and a history for the entire mission.
2. Add the ability to change servings per astronaut (e.g. if a portion is not sufficient)
3. Edit menus per astronaut (e.g. who does not like a dish and not wishing to take another)
4. Show on the right a histogram with important nutritional information
5. Add the possibility to print the menu?



Magnesium	21	mg
Sodium	2.7	mg
Potassium	417	mg

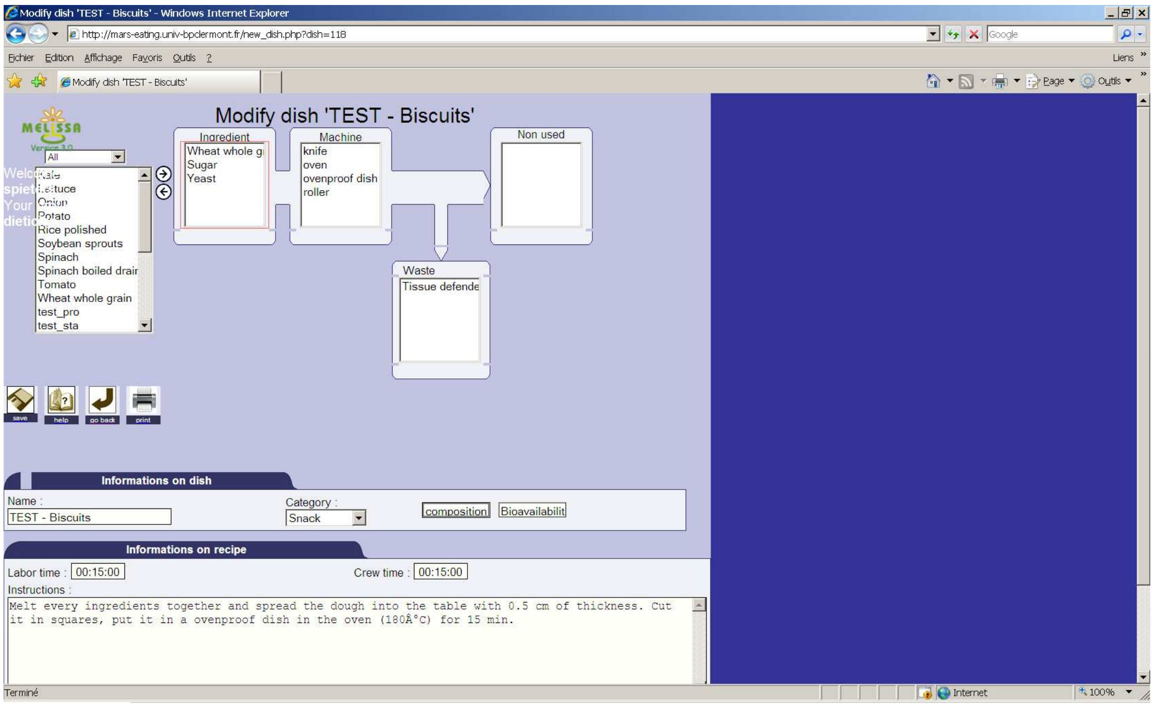
Trace elements

Iron	424	µg
Copper	89	µg
Manganese	147	µg
Fluoride	9.7	µg
Zinc	345	µg
Selenium	1.5	µg
Iodine	2.4	µg
Chromium	2.5	µg

Amino acids

Histidine	40	mg
Isoleucine	100	mg
Leucine	140	mg
Lysine	130	mg
Methionine	30	mg
Phenylalanine	100	mg
Threonine	90	mg
Tryptophan	30	mg
Valine	130	mg

We have to use standard food databases. For this IPL proposes to use the INFOODS system (see annexes 6 and 7).



Remarks:

1. The introduction of a new recipe crashes when we wish to register it.
2. As a dietitian I am not able to add ingredients

Proposal:

1. It would be easy if ingredients could be moved into the relevant tables/lists by use of a simple drag and drop. The software should then automatically request the quantity needed and the unit of the ingredient that was moved.

2. Dietician should be able to change the composition of ingredients if necessary.

3. Indicate the number of servings or portions per recipe

4. Add indications in the recipe card, the percentage of water evaporation, alcohol evaporation, fat absorption, ...

5. Indicate in the unused part of the screen the calculated nutritional composition of the recipe. The most important data are included in Annex 9

6. Add a module taking into account the nutritional losses during cooking. (Annexes 8 and 10)

UBP propositions 3 : Interface planning

UBP propositions : Interface planning **Critical revision:** The print function should be added and a menu for 30 days instead of 10 days may be proposed. **Major revisions** 1. In the long term, the minimum water quantities that need to be drunk should be added. Therefore, we must calculate the water requirement for the crew (the sum of the requirements of each crew member) and then subtract the water provided by each astronaut. This will ensure that the crew must still drink. 2. Furthermore it would be essential to create a stock management system between the harvesting stage and the cooking stage. The team could enter their fresh plant production in the stock and the system would remove it again when the dishes are added to the menu. 3. A separate menu per crew member: a concept or a reality?

UBP propositions 4 : Interface tools

UBP propositions : Interface tools

Critical revision:

1. The food or recipe weight that relates the nutritional composition is not specified, it should be indicated, and it is 100g.
2. Dietitians should be able to save stabilized and processed ingredients (see changes in permission table).

Minor revision

The code of each ingredient must be indicated because it is an international code for food (Langual code) (Vasquez-Caicedo et al, 2005).

Major revision

Ergonomics of ingredients management interface should be revised.

Due to the Labor harvest index it should be useful to add parameters (volume, mass, time) for future ESM calculation.

UBP propositions 5 : Conclusion – General critical revision

UBP propositions : Conclusion : General critical revision

1. A track changes tool should be added to the database to ensure its proper development

2. A reference tag should be associated to the data (composition / recipes / dishes composition..)

3. A technical document for the database and the interface is required to maintain the knowledge of the software and transfer the knowledge to new developer's teams.

4. In this way, conceptual schemes have been developped to explain the biological philosophy between the different data base tables.

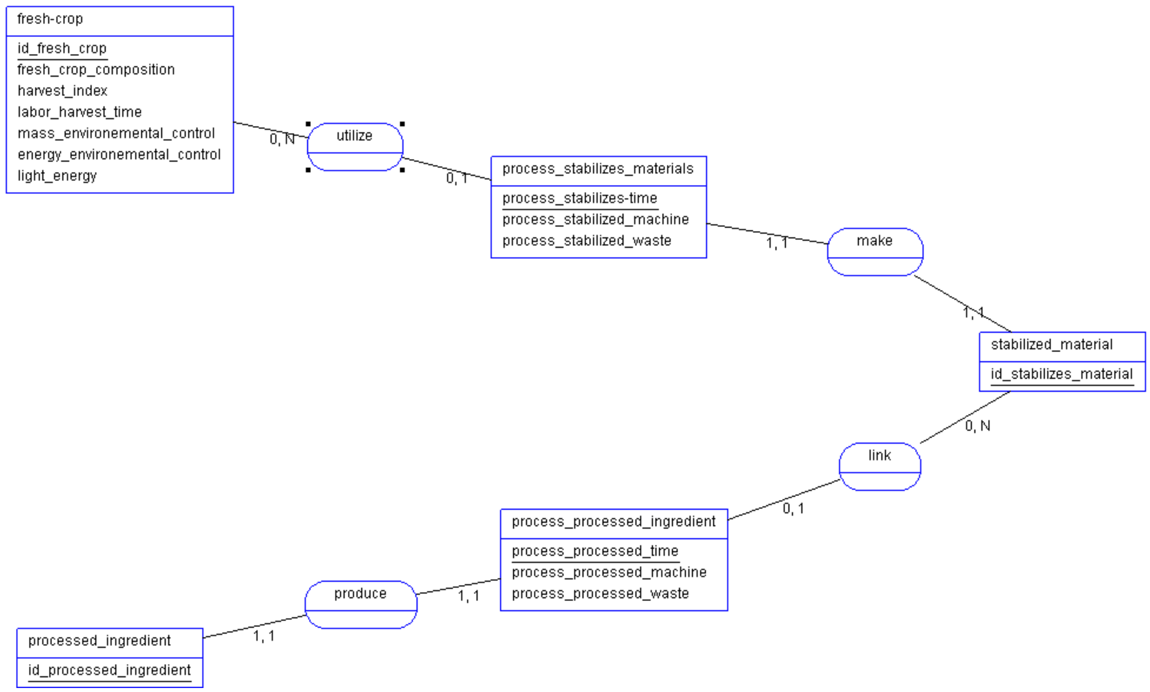


Figure 1 : Biological philosophy between the different data base tables.

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Annex 1: Nutritional requirement estimates for a moon and mars mission

Nutrients	Units	**Moon**	**Mars**
Energy expenditure	kilocalories (kcal) or kilojoules (kJ) 1 kJ = 4.184 kcal	40-45 $kcal.kg^{-1}.d^{-1}$ Example : M :70 kg = 2800-3150 kcal W : 56 kg = 2240- 2520 kcal	40-45 $kcal.kg^{-1}.d^{-1}$ Example : M :70 kg = 2800-3150 kcal W : 56 kg = 2240- 2520 kcal
		M: < 30 y. 1.7*(15.3*W+679) M: > 30 y. 1,7*(11,6*W+879) W: < 30 y. 1,6*(14,7*W+496) W: > 30 y. 1,6*(8,7*W+829) Example : M :70 kg < 30 y. = 2975 kcal M: 70 kg > 30 y. = 2875 kcal W : 56 kg < 30 y. = 2110 kcal W : 56 kg > 30 y. = 2105 kcal	M: < 30 y. 1.7*(15.3*W+679) M: > 30 y. 1,7*(11,6*W+879) W: < 30 y. 1,6*(14,7*W+496) W: > 30 y. 1,6*(8,7*W+829) Example : M :70 kg < 30 y. = 2975 kcal M: 70 kg > 30 y. = 2875 kcal W : 56 kg < 30 y. = 2110 kcal W : 56 kg > 30 y. = 2105 kcal
EVA	kJ/h (kcal/h)	M: 500 – 1300 (120-310) W: 670 (160)	TBD
	$kJ.kg^{-1}.h^{-1}$ $kcal.kg^{-1}.h^{-1}$	M : 10.5$\pm$2.4 (2.5$\pm$0.6) W : 10.9$\pm$2.3 (2.6$\pm$0.6)	TBD
Moon :Driving or riding in the lunar rover (Schoeller, 2000)	kJ/h (% less at earth)	510 (40%)	Comprise between 40 and 0% of earth expenditure
Moon : various experiments outside the lunar module (Schoeller, 2000)	kJ/h (% less at earth)	950 (49)	Comprise between 49 and 0% of earth expenditure
Moon : general activities (Schoeller, 2000)	kJ/h (% less at earth)	1150 (28)	Comprise between 28 and 0% of earth expenditure
Protein	% total energy consumed	10-15 (max 25)	10-15 (max 25)
	g N g/ energy(no protein)	First 2 months : 1.5 to 1.7 $g.kg^{-1}.d^{-1}$ after 1.2 $g.kg^{-1}.d^{-1}$ Minimum 0.8 $g.kg^{-1}.d^{-1}$ 1g N / 150 – 200 kcal	First 2 months : 1.5 to 1.7 $g.kg^{-1}.d^{-1}$ after 1.2 $g.kg^{-1}.d^{-1}$ Minimum 0.8 $g.kg^{-1}.d^{-1}$ 1g N / 150 – 200 kcal

Nutrients	Units	**Moon**	**Mars**
Indispensable amino acids			
Histidine	mg/g protein	15	15
	mg/kg per day	10	10
Isoleucine	mg/g protein	30	30
	mg/kg per day	20	20
Leucine	mg/g protein	59	59
	mg/kg per day	39	39
Lysine	mg/g protein	45	45
	mg/kg per day	30	30
Methionine and Cysteine	mg/g protein	22	22
	mg/kg per day	15	15
Methionine	mg/g protein	16	16
	mg/kg per day	10	10
Cysteine	mg/g protein	6	6
	mg/kg per day	4	4
Phenylalanine & Tyrosine	mg/g protein	38	38
	mg/kg per day	25	25
Threonine	mg/g protein	23	23
	mg/kg per day	15	15
Tryptophane	mg/g protein	6	6
	mg/kg per day	4	4
Valine	mg/g protein	39	39
	mg/kg per day	26	26
Total indispensable amino acids	mg/g protein	277	277
	mg/kg per day	184	184

Nutrients	Units	**Moon**	**Mars**
Carbohydrates	% total energy consumed	50 – 55 (45 – 65)	50 – 55 (45 – 65)
	g	4 – 6 $g.kg^{-1}.d^{-1}$ Before EVA : 1-4 $g.kg^{-1}.d^{-1}$, 1-4 h before During EVA, at least 37g CHO/hour or 1 g $CHO.kg^{-1}.h^{-1}$	4 – 6 $g.kg^{-1}.d^{-1}$ Before EVA : 1-4 $g.kg^{-1}.d^{-1}$, 1-4 h before During EVA, at least 37g CHO/hour or 1 g $CHO.kg^{-1}.h^{-1}$
Added sugar	% total energy consumed	<10	<10
Total fiber	g	>30 g	>30g
Fat	% total energy consumed	20-35	20-35
n-6 polyunsaturated fatty acids (linoleic acid)	% total energy consumed	5 - 10	5 - 10
	g		
n-3 polyunsaturated fatty acids (a-linolenic acid)	% total energy consumed	0,6 – 1.2	0,6 – 1.2
	g		
Saturated and trans fatty acids	% total energy consumed	nd	nd
Fluid	ml per kcal	1-1.5	1-1.5
	Litres	M : 3-4.5 W : 2,1-3.1 At least 2000 ml/d	M : 3-4.5 W : 2,1-3.1 At least 2000 ml/d
	If physical activity or EVA	Min 600 ml/h of effort	Min 600 ml/h of effort
Vitamin A (includes provitamin A carotenoids)	µg retinol equivalent	M: 1000 W: 1000 Max : 3000	M : 1000 W : 1000 Max : 3000
Vitamin D (calciferol)	µg	M : 5-10 W : 5-10 Max : 50 risk of deficiency	M : 5-10 W : 5-10 Max : 50 risk of deficiency

Nutrients	Units	**Moon**	**Mars**
Vitamin E (a-tocopherol)	mg α-tocopherol equivalent	M : 10-20 W : 10-20 Max : 300	M : 10-20 W : 10 -20 Max : 300
Vitamin K	µg	M : 50-70 W : 50-70 Max : nd	M : 65-120 W :55-90 Max : nd
Vitamin C (ascorbic acid, dehydroascorbic acid)	mg	M : 75-100 W : 75 -100 Max : 2000	M : 75-100 W : 75 -100 Max : 2000
Vitamin B12 (cobalamin)	µg	M : 2.4 W : 2.4 Max : nd risk of deficiency	M : 2.4 W : 2.4 Max : nd risk of deficiency
Vitamin B6 (pyridoxal, pyridoxine, pyridoxamine, 5'-phosphates (PLP, PNP, PMP)	mg	M : 1.3 - 2 W : 1.3 - 2 Max : 100	M : 1.3 - 2 W : 1.3 - 2 Max : 100
Thiamin (B1; aneurine)	mg	M : 1.2 – 1.5 W : 1.1 -1.5 Max : nd	M : 1.2 – 1.5 W : 1.1 -1.5 Max : nd
Riboflavin (B2)	mg	M : 1.3 - 2 W :1.1 - 2 Max : nd risk of deficiency	M : 1.3 - 2 W :1.1 - 2 Max : nd risk of deficiency
Folate	µg	M : 400 W : 400 Max : 1000	M : 400 or more ? W : 400 or more ? Max : 1000
Niacin	mg Niacin equivalents	M : 16 - 20 W : 14 - 20 Max : 35	M : 16 - 20 W : 14 - 20 Max : 35
Biotin	µg	M : 30 W : 30 Max :nd	M : 30 W : 30 Max :nd
Pantothenic Acid	mg	M : 5 W : 5 Max :nd	M : 5 W : 5 Max :nd
Calcium	mg	M : 1200 W : 1200	M : 1200 W : 1200

Nutrients	Units	**Moon**	**Mars**
		Max : 2500	Max : 2500
Phosphorus	mg	M : 800 W : 800 Max : 4000	M : 800 W : 800 Max : 4000
Calcium/Phosphorus		1.5	1.5
Magnesium	mg	M :260 - 420 W : 220 - 320 Max : 3500	M :260 - 420 W : 220 - 320 Max : 3500
Sodium	mg	M : 2000-2500 W : 2000-2500 Max : 3500	M : 2000-2500 W : 2000-2500 Max : 3500
Chloride	mg	M : 3000-3800 W : 3000-3800 Max : 5400	M : 3000-3800 W : 3000-3800 Max : 5400
Potassium	mg	M : 3000-4000 W : 3000-4000 Max : nd	M : 3000 - 4000 W : 3000 - 4000 Max : nd
Iron	mg	M : 10 W : 10 Max : 45 risk of deficiency	M : 10 W : 19.6 Max : 45 risk of deficiency
Copper	mg	M : 1.5 – 3.0 W : 1.5 – 3.0 Max : 5.0	M : 1.5- 3.0 W : 1.5 – 3.0 Max : 5.0
Manganese	mg	M : 2.0 W : 2.0 Max : 5.0	M : 2.0 W : 2.0 Max : 5.0
Fluoride	mg	M : 3 W : 3 Max : 10	M : 3 W : 3 Max : 10
Zinc	mg	M : 4.2 - 15 W : 3 - 15 Max : 40	M : 4.2 - 15 W : 3 - 15 Max : 40
Selenium	µg	M : 70 W : 60 Max : 400	M : 70 W : 60 Max : 400
Iodine	µg	M : 150 W : 150 Max :1100 Risk of deficiency	M : 150 W : 150 Max :1100 Risk of deficiency
Chromium	µg	M : 35	M : 35

Nutrients	Units	**Moon**	**Mars**
		W : 25 Max : 250 as supplement	W : 25 Max : 250 as supplement
Molybdene	µg	M : 45 -50 W : 45 - 50 Max : 2000	M : 45 -50 W : 45 - 50 Max : 2000
Choline	mg	M : 550 W : 425 Max :nd	M : 550 W : 425 Max :nd
Arsenic	mg	M : nd W : nd Max :nd	M : nd W : nd Max :nd
Boron	mg	M : nd W : nd Max :nd	M : nd W : nd Max :nd
Nickel	mg	M : nd W : nd Max :1	M : nd W : nd Max :1
Silicon	mg	M : nd W :nd Max :nd	M : nd W :nd Max :nd
Vanadium	mg	M : nd W : nd Max : 1.8	M : nd W : nd Max : 1.8
Inorganic sulfate	mg	M : nd W : nd Max :nd	M : nd W : nd Max :nd

Male astronaut weight preflight 75 kg, In flight 73kg

Annex 2 : List of nutrients to include in MELiSSA food database based on INFOODS standards

TAGNAME WITH UNIT	Component name	Definition	Unit	maximal number of decimal points
ESSENTIALS				
DEN	Density		g/mL	2
EDIBLE	Edible portion coefficient			2
ENERC(KJ) (STANDARDIZED)	Energy (standardized)	sum of carbohydrates x 17 + protein x 17 + fat x 37 + alcohol x 29 + dietary fibre x 8	kJ	0
ENERC(KCAL) (STANDARDIZED)	Energy (standardized)	sum of carbohydrates x 4 + protein x 4 + fat x 9 + alcohol x 7 + dietary fibre x 2	kcal	0
WATER	Water		g	1
XN	conversion factor to calculate total protein from nitrogen			2
NT	Nitrogen, total		g	2
PROTCNT	protein, total; calculated from total nitrogen		g	2
PROPLA	protein from plant origin		g	2
PROANI	protein from animal origin		g	2
FAT (STANDARDIZED)	fat, total (standardized)		g	2
FASAT	fatty acids, total saturated		g	2
FAMS	fatty acids, total monounsaturated		g	2
FAPU	fatty acids, total polyunsaturated		g	2
FATRN	fatty acids, total trans		g	2
CHOL-	Cholesterol, method unknown		mg	2
CHOAVLDF (STANDARDIZED)	carbohydrate, available; calculated by difference (standardized)		g	2
STARCH	starch, available		g	2
SUGAR	sugar		g	2
ADSUGAR	sugar, added		g	2
FIBTG (STANDARDIZED)	fibre, total dietary; determined gravimetrically by the AOAC total dietary fibre method (Prosky and similar methods) (standardized)		g	2
FIB-	fibre; method of determination unknown or mixed methods		g	2

FIBINS	Fibre, water-insoluble		g	2
FIBSOL	Fibre, water-soluble		g	2
ALC	alcohol		g	2
MINERALS				
ASH	ash		g	2
CA	calcium		mg	2
FE	iron		mg	2
MG	magnesium		mg	2
P	phosphorus		mg	2
K	potassium		mg	2
NA	sodium		mg	2
CLD	Chloride		mg	2
ZN	Zinc		mg	2
CU	copper		mg	2
MN	manganese		mg	2
ID	iodine		µg	2
FD	Fluoride		µg	2
MO	Molybdenum		µg	2
SE	selenium		µg	2
CO	cobalt		µg	2
B	Boron		µg	2
BRD	Bromide		µg	2
NI	Nickel		µg	2
Cr	Chromium		µg	2
V	Vanadium		µg	2
As	Arsenic		µg	2
VITAMINS				
VITA_RAE (STANDARDIZED) CHOOSEN BETWEEN VITA_RAE AND VITA	vitamin A; retinol activity equivalent (standardized)		µg	2
VITA	vitamin A; calculated by summation of the vitamin A activities of retinol and the active carotenoids	Total vitamin A activity = mcg retinol + 1/6 mcg beta-carotene + 1/12 mcg other provitamin A carotenoids.	µg	2
RETOL	retinol		µg	2
CARTBEQ	beta-carotene equivalents	This value is the sum of the beta-carotene plus ½ the quantity of the other carotenoids with vitamin A activity	µg	2
VITD (STANDARDIZED)	vitamin D (D2+D3) (standardized)		µg	2

VITDEQ	vitamin D equivalent	Vitamin D3 + 5 x 25-hydroxycholecalciferol	µg	2
VITE (STANDARDIZED) CHOOSEN FROM VITE AND TOCPHA	vitamin E ; calculated by summation of the vitamin E activities of the active tocopherols and tocotrienols; expressed as alpha-tocopherol equivalents (standardized)	VITE = a-tocopherol + 0.4 b-tocopherol + 0.1 g-tocopherol + 0.01 d-tocopherol	mg	2
TOCPHA	alpha-tocopherol		mg	2
VITK	vitamin K, total		µg	2
THIA	thiamin		mg	2
RIBF	riboflavin		mg	2
NIAEQ (STANDARDIZED) CHOSEN FROM NIA AND NIAEQ	niacin equivalents, total (standardized)	NIAEQ = niacin + 1/60 tryptophan	mg	2
PANTAC	pantothenic acid		mg	2
VITB6C (STANDARDIZED)	vitamin B-6, total; calculated by summation (standardized)		mg	2
FOL (STANDARDIZED)	folate, total; microbiological assay (standardized)		µg	2
DFE	folate, dietary folate equivalent	Dietary folate equivalent (DFE) = food folate (pteroylpolyglutamates) + 1.7 x synthetic folic acid (pteroylmonoglutamic acid)	µg	2
BIOT	biotin		µg	2
VITB12	vitamin B-12		µg	2
VITC (STANDARDIZED)	vitamin C (standardized)	L-ascorbic acid + L-dehydroascorbic acid	mg	2
SPECIAL CARBOHYDRATES				
FRUS	Fructose		g	2
GLUS	Glucose		g	2
LACS	Lactose		g	2
MALS	Maltose		g	2
AMYP	Amylopectin		g	2
AMYS	Amylose		g	2
DEXTN	Dextrins		g	2
SUCS	Saccharose		g	2
FATTY ACIDS				
F4D0	C 4:0		g	2
F6D0	C 6:0		g	2
F8D0	C 8:0		g	2

F10D0	C 10:0		g	2
F12D0	C 12:0		g	2
F14D0	C 14:0		g	2
F15D0	C 15:0		g	2
F16D0	C 16:0		g	2
F17D0	C 17:0		g	2
F18D0	C 18:0		g	2
F20D0	C 20:0		g	2
F22D0	C 22:0		g	2
F24D0	C 24:0		g	2
F14D1CN5	C 14:1 cis, n-5		g	2
F16D1CN7	C 16:1 cis n-7		g	2
F18D1N9	C 18:1, n-9		g	2
F18D1CN7	C 18:1, cis n-7		g	2
F20D1CN11	C 20:1, n-11		g	2
F22D1CN9	C 22:1, n-9		g	2
F22D1CN11	C 22:1, n-11		g	2
F24D1CN9	C 24:1, cis, n-9		g	2
F18D2CN6	C 18:2, cis, n-6		g	2
F18D3CN3	C 18:3, cis, n-3		g	2
F18D4CN3	C 18:4, cis, n-3		g	2
F20D4CN6	C 20:4, cis, n-6		g	2
F20D5CN3	C 20:5, cis, n-3		g	2
F22D5CN3	C 22:5, cis, n-3		g	2
F22D6CN3	C 22:6, cis, n-3		g	2
FAPUN3	Sum n-3 fatty acids		g	2
FAPUN6	Sum n-6 fatty acids		g	2
AMINO ACIDS				
ILE	Isoleucin		mg	2
LEU	Leucine		mg	2
LYS	Lysine		mg	2
MET	Methionine		mg	2
CYS	Cystine		mg	2
PHE	Phenylalanine		mg	2
TYR	Tyrosine		mg	2
THR	Threonine		mg	2
TRP	Tryptophan		mg	2
VAL	Valine		mg	2
ARG	Arginine		mg	2

HIS	Histidine		mg	2
ALA	Alanine		mg	2
ASN	Aspartic acid		mg	2
GLU	Glutamic acid		mg	2
GLY	Glycine		mg	2
PRO	Proline		mg	2
SER	Serine		mg	2
POLYPHENOLS				
POLYPHEN	polyphenols		mg	2
LYCPN	lycopene		µg	2
LUTN	lutein		µg	2
LUTNZEA	Lutein+Zeaxanthin		µg	2
ANTHOCYAND	Anthocyanidins		µg	
FLAVONOLS	flovonols		µg	2
	Monomeric flavanols		µg	2
FLAVANONES	Flavanones		µg	2
ISOFLVND	Total Isoflavonoids		µg	2
DDZEIN	Daidzein		µg	2
GNSTEIN	Genistein		µg	2
OTHERS				
HISTN	Histamine		mg	2
SEROTN	Serotonine		Mg	2
TRYPN	Tryptamine		µg	2
TYRA	tyramine		µg	2
PURN	Purines		mg	2
NITRA	Nitrates		mg	2
NITRI	Nitrites		mg	2
SULFT	Sulfates		mg	2
PLOLS	Polyols		g	2
OXAACT	Oxalic acid		mg	2

Annex 3: Anthropometrical data

GENERAL MEASUREMENTS	
Height (m)	
Weight (kg)	
Body Mass Index	= Weight (kg)/Height (m)²
Body surface (m²)	Body surface: (weight^0.425) * (height^0.725) * 71.84 * 0.0001 weight(kg) height(cm)
IMPEDANCEMETRY	
Impedance (ohm)	Given by impedancemetry
Fat mass (%)	Given by impedancemetry
Fat mass (kg)	= (weight(kg) * fat(%)) / 100
Lean mass (%)	= 100-Fat mass(%)
Lean mass (kg)	= (weight (kg)* Lean mass(%))/100
Min. Lean mass (kg)	
Max. Lean mass (kg)	
Total water (%)	Given by impedancemetry
Total water (l)	= (weight (kg)*Total water(%))/100
SKIN FOLDS	
Biceps (mm)	
Triceps (mm)	
Shoulder blade (mm)	
Supraspinal (mm)	
Hip (mm)	
Chest (mm)	
Abdomen (mm)	
Front Thigh (mm)	
Back Thigh (mm)	
calf (mm)	
Cheek (mm)	
Chin (mm)	
Ribs (mm)	
Knee (mm)	
% Fat Mass 3 folds	Jackson & Pollock method (1978; 1980). Fat ratio calculated from the sum of 3 folds: (M) chest, abdomen, thigh (F) triceps, hip, thigh Male: g = 1.1098 - 0.0008267*s + 0.0000016*s^2 - 0.0002574*age Female: g = 1.09949 - 0.0009929*s + 0.0000023*s^2 - 0.0001392*age % Fat = ((4.95/g)-4.5) * 100 A=Sum 3 folds(mm)
% Fat Mass 4 folds	Durnin & Womersley method (1974). Fat ratio calculated from the sum of 4 folds: biceps, triceps, shoulder blade, hip A = Age d = 1,1714 - 0.063 * log(S) - 0.000406*A

	Fat mass [%] = 495 / d - 450
% Fat MAss 6 folds	**Yuhasz Equation for men:** % Body Fat = (0.1051 x sum of triceps, subscapular, supraspinale, abdominal, thigh, calf) + 2.585 **Yuhasz equation for women:** % Body Fat = (0.1548 x sum of triceps, subscapular, supraspinale, abdominal, thigh, calf) + 3.580 And figure for man and figure for women
PERIMETERS	
Wrist perimeters (cm)	
Right arm (cm)	
Muscular arm circonference (mm)	MAC (cm) = CB (cm) - [0,314 x Tricipital skin fold (mm)*2] (minimum = 170 mm men and 160 mm women)
biceps contracted (cm)	
Left arm (cm)	
Right forearm (cm)	
Left forearm (cm)	
Shoulders (cm)	
Chest (cm)	
Waist (cm)	
Navel (cm)	1
Hip (cm)	
Pubis (cm)	
Right thigh (cm)	
Left thigh (cm)	
Right calf (cm)	
Left calf (cm)	
Waist/Hip ratio	Ratio: Waist/Hip
Morphology	Morphology deducted from ratio: Waist/Hip Android: ratio > 1.0 (for men) or 0.85 (for women) Gynoid: ratio < 0.9 (for men) or 0.70 (for women) Mixed: in other cases

Annex 4 : Yuhatz skin folds table for men

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Tableau 2.3. Mesures des plis cutanés (en mm) chez l'homme jeune.

Date: ____________ Nom: ______________________________

Poids: ________ (kg)

Mesures en mm

Classification	Poitrine	Triceps	Sous-scapulaire	Sus-iliaque	Abdomen	Face antérieure de la cuisse	Total	% de graisse	Score
Déficient									100
		0.0							95
		0.2	0.0			0.0			90
Très mince		1.2	1.4			1.5	3.1	3.8	85
		2.1	2.8	0.0	0.0	3.1	12.9	4.9	80
	0.8	3.1	4.2	1.2	1.9	5.2	23.7	5.9	75
Mince	2.8	4.0	5.6	3.6	4.3	7.0	32.5	6.7	70
	4.8	5.0	7.0	6.1	6.7	8.9	42.3	7.7	65
	6.8	6.0	8.4	8.5	9.2	10.7	52.3	8.7	60
Moyen	8.8	7.9	9.8	11.0	11.6	12.6	61.9	9.7	55
	10.8	8.8	11.2	13.5	14.0	14.4	72.0	10.6	50
	12.8	9.8	12.6	15.9	16.4	16.2	81.5	11.5	45
Replet	14.8	10.8	14.0	18.3	18.8	18.1	91.3	12.5	40
	16.8	11.7	15.4	20.8	21.2	19.9	101.1	13.4	35
	18.8	12.7	16.8	23.2	23.7	21.8	110.9	14.4	30
Gros	20.8	13.6	18.2	25.7	28.1	23.6	120.7	15.4	25
	22.8	14.6	19.6	28.2	28.5	25.4	130.5	16.3	20
	24.8	15.6	21.0	30.6	30.9	27.3	140.3	17.2	15
Obèse	26.8	16.5	22.4	33.0	33.4	29.1	150.1	18.2	10
	28.8	17.5	23.8	35.5	35.7	30.9	160.1	19.2	5
	30.8	18.4	25.2	38.0	38.2	32.7	170.0	2.1	0

Annex 5 : Yuhatz skin folds table for women

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Tableau 2.4. Mesures des plis cutanés (en mm) chez la femme jeune.

Date: ______________ Nom: ____

Poids: ________ (kg)

Mesures en mm

Classification	Triceps	Sous-scapulaire	Sus-iliaque	Abdomen	Face antérieure de la cuisse	Face postérieure de la cuisse	Total	% de graisse	Score
Très mince		1.6			5.6	5.1	28.4	<8	100
	1.1	2.7			8.0	7.4	37.5	<8	95
	2.9	3.9	0.6	1.1	10.4	9.7	46.5	<8	90
Mince	4.6	5.0	2.0	3.4	12.8	12.0	56.6	8	85
	6.3	6.1	3.4	5.8	15.2	14.3	64.7	10	80
	8.1	7.2	4.8	8.1	17.6	16.6	73.7	12	75
Idéale	9.8	8.4	6.2	10.4	20.0	18.9	82.8	14	70
	11.6	9.5	7.5	12.7	22.4	21.2	91.8	16	65
	13.3	10.6	8.9	15.0	24.8	23.5	100.9	18	60
Moyenne	15.0	11.8	10.3	17.3	27.2	25.8	109.9	20	55
	16.8	12.9	11.7	19.6	29.6	28.1	119.0	22	50
	18.5	14.1	13.1	21.9	32.0	30.4	128.0	24	45
Replète	20.3	15.2	14.4	24.2	34.4	32.7	137.1	26	40
	22.0	16.3	15.8	26.5	36.8	35.0	146.1	28	35
	23.7	17.4	17.2	28.9	39.2	37.3	155.2	30	30
Grosse	25.5	18.6	18.5	31.2	41.6	39.6	164.2	32	25
	27.2	19.7	20.0	33.5	44.0	41.9	173.3	34	20
	29.0	20.8	21.3	35.8	46.4	44.2	182.3	36	15
Obèse	31.7	22.0	22.7	38.1	48.8	46.5	191.4	>36	10
	33.4	23.1	24.1	40.4	51.2	48.8	200.4	>36	5
	35.2	24.2	25.5	42.7	53.6	51.1	209.5	>36	0

Annex 6 : System for describing MELiSSA plants, foods, ingredients

INFOODS System for Describing Foods

Use English, French, or Spanish, except for B1 and B2.

A. Source of food name(s) and descriptive terms. These may be discerned from the food obtained for analysis (visually and/or using label information),
OR taken from a database (hard copy or tape),
OR from a published paper, laboratory report, or thesis,
OR obtained from someone familiar with the food,
OR obtained from a combination of the above sources.

B. Name and identification of the food

1. Name of food in a national language of the country (name of the national language).
2. Local name of food (name of local language or dialect).
3. Nearest equivalent name of this food in English, French, or Spanish.
4. Country or area in which sample of food was obtained.
5. Food group and code for this food in database used in the country (give database citation).
6. Food group and code for food in regional nutrient database (give database citation).
7. Codex Alimentarius or INFOODS food indexing group.

Compare food against definitions of "single" and "mixed" (multi-ingredient) foods.
For "single" food, answer Section C.
For "mixed" food or if uncertain, answer Section D.

C. Description of "single" foods

1.
   a. Food source (in English, French, or Spanish).
   b. Scientific name of food source (Latin).
   c. Variety, breed, or strain.
2. Part of plant or animal.
3. Country or area of origin.
4. Manufacturer's name and address. Batch or lot number.
5. Other ingredients (including additives).

6. Food processing and/or preparation; where processed/prepared.
7. Preservation method.
8. Degree of cooking.
9. Agricultural production conditions.
10. Maturity or ripeness.
11. Storage conditions.
12. Grade.
13. Container and food contact surface.
14. Physical state, shape, or form.
15. Color.
16. Other descriptors not covered above.
17. Availability and location of photograph or drawing of this food.

D. Description of "mixed" (multi-ingredient) foods

1. Ingredients and quantities if available; source of ingredient information.
2. Recipe procedure.
3. Place where multi-ingredient food was made.
4. Availability and location of photograph or picture.
5. Manufacturer's name and address.
6. Container and food contact surface.
7. Preservation method.
8. Storage conditions.
9. Final preparation of this multi-ingredient food.

E. Customary uses of food Optional for single or mixed foods

1. Typical portion weight and corresponding household measure or size.
2. Availability; frequency and season of consumption.
3. Usual place of food in the diet (time of day, place in meal, etc.).
4. Food users.
5. Specific purposes of the food; special claims.

The next section is essential information for all foods. It may be coupled with the numerical component data or with the food name.

F. Sampling and laboratory handling of food

1. Date of collection.
2. Weight(s) of sample(s).
3. Percentage edible portion; nature of edible portion.
4. Percentage of refuse; nature of refuse.

5. Place of collection: supplier(s); type of outlet(s).
6. Handling between supplier and laboratory.
7. Handling on arrival at laboratory.
8. Laboratory storage and subsequent handling.
9. Strategy for analyses.
10. Reason for doing analyses.

Annex 7: INFOODS codes

progress codes	
a	first compilation: copy values from the original food composition table
b	second compilation: completion of values but not complete
c	compilation completed: all first priority nutrients are completed
d	values rechecked and ready for printing
Food types	
R	Recipe or calculated based on a raw food
F	Food taken as such from FCT
tr	trace
Documentation at value or food level	
est.	estimated
est. Z	estimated zero
calc.	calculated
calc. with mixed method	calculated with mixed method
calc. with recipe method	calculated with recipe method
calc. with ingredient method	calculated with ingredient method
Source types	
E	Value is imputed, estimated, or guessed
A	Adapted from source food
S	According to standards
Z	Presumed zero
C	calculated
A	Analyzed
or	
AO	Original analytical data
ASC	Analytical data from scientific literature
AAG	Aggregated of analytical values
AI	From non-scientific journal publication
ESTIM	Imputed/estimated
FCDB	From food composition tables, databases or datasets
LABEL	Food label, product information

LC	Claim
MANUF	Supplied by manufacturer
HOST	Value created within host-system
RECIP	Calculated through recipes
ASSUM	Presumed value
Z	Assumed zero value
W	Unknown water value of derived sample
OTHER	Other source type
X	Source type not known
Formula to calculate 100g cooked dish based on 100g edible raw food	
NV(cooked) = NV(raw) x 1/YF x RF	
NV	Nutrient value
YF	yield factor
RF	retention factor
valtype	
&gt	more than
&lt	less than
tr	trace
<LOQ	under limit of quantification
<LOD	under limit of detection
halfLOQ	half of limit of quantification
halfLOD	half limit of detection
ND	non detected
MN	mean
MD	median
MO	mode
Units	
kg	kilogram
G	gram
mg	milligram
mcg	microgram
ng	nanogram

pg	picogram
Bq	Becquerel
L	Liter
mL	milliliter
uL	microliter
mmol	millimol
kJ	kilojoule
kcal	kilocalorie
ppm	parts per million
R	Ratio
X	not applicable
Base quantitiy/ denominator	
W	per 100g edible portion
T	per 100g total food
D	per 100g dry weight
WKG	per kg edible portion
TKG	per kg total food
DKG	per kg dry weight
VL	per l food volume
V	per 100 ml food volume
N	per g total nitrogen
NH	per 100 g nitrogen
AS	per 100 g total amino acid
P	per 100 g protein
TFA	per g total fatty acids
F	per 100 g total fatty acids
FT	per g total fat
FTG	per g fat as triglyceride equivalent
TF	per 100g total fat
TTG	per 100g fat as triglyceride equivalent
X	not applicable
Derivation Type	
A	Analytical data

AI	Analytical data; from the literature or government; incomplete documentation
AR	Analytical data; derived by linear regression
AS	Analytical data; derived by summation of analytical data and assumed zero
BU	Based on another form of the food or similar food, unknown further procedures
BD	Based on same food; Drained solids from solids and liquids or vice versa (canned fruits and vegetables)
BFAN	Based on another form of the food or similar food; Concentration adjustment for Ash; Retention factors not used
BFCN	Based on another form of the food or similar food; Concentration adjustment for Carbohydrate; Retention factors not used
BFFN	Based on another form of the food or similar food; Concentration adjustment for Fat; Retention factors not used
BFFY	Based on another form of the food or similar food; Concentration adjustment for Fat; Retention factors used
BFNN	Based on another form of the food or similar food; Concentration adjustment for Non-fat solids; Retention factors not used
BFNY	Based on another form of the food or similar food; Concentration adjustment for Non-fat solids; Retentions factors used
BFPN	Based on another form of the food or similar food; Concentration adjustment for Protein; Retention factors not used
BFPY	Based on another form of the food or similar food; Concentration adjustment for Protein; Retention factors used
BFSN	Based on another form of the food or similar food; Concentration adjustment for Solids; Retention factors not used
BFSY	Based on another form of the food or similar food; Concentration adjustment for Solids; Retention factors used

BFYN	Based on another form of the food or similar food; Yield adjustment; Retention factors not used
BFZN	Based on another form of the food or similar food; No concentration adjustment; Retention factors not used
BFZY	Based on another form of the food or similar food; No concentration adjustment; Retention factors used
BNA	Based on another form of the same food or similar food: constituents normalized to total weight; vitamin A adjusted
CAU	Calculated from different food or average values of food category, unknown further procedures
CAAN	Calculated average values of food category for Ash; Retention factors not used
CACN	Calculated average values of food category for Carbohydrate; Retention factors not used
CAFN	Calculated average values of food category for Fat; Retention factors not used
CASN	Calculated average values of food category for Solids; Retention factors not used
CAZN	Calculated average values of food category; No adjustment; Retention factors not used
DA	Concentration adjustment using factor; derived from analytical data
DI	Concentration adjustment using factor; derived from imputed data
FLA	Estimated formulation based on ingredient list; Linear program used to estimate ingredients based on Analytical data
FLC	Estimated formulation based on ingredient list; Linear program used to estimate ingredients based on Claim on label/serving
FLM	Estimated formulation based on ingredient list; Linear program used to estimate ingredients based on manufacture's calculation for data per 100g edible food
JA	Aggregated data involving combinations of analytical data

JO	Aggregated data involving combinations of data with partial analytical data or aggregation of analytical data
LC	Label claim serving (g or %RDI or RDA) are back calculated by compiler to per 100g food
MA	Manufacturer supplied (industry or trade association) analytical data, incomplete documentation
MC	Manufacturer supplied; Calculated by manufacturer or unknown if analytical or calculated
ML	Manufacturer supplied; Value upon which manufacturer based label claim for fortified/enriched nutrient
NC	Nutrient that is based on other nutrient/s; calculated rather than analyzed
NP	Nutrient that is based on other nutrient/s; calculated by difference or summed (with or without activity factors)
NR	Nutrient that is based on other nutrient/s; value used directly, ex. fat from total fatty acids
PAE	Based on estimated segment reconstitution; Derived from analytical data;
PAK	Based on known segment reconstitution; Derived from analytical data; Known segment reconstitution
PIE	Based on estimated segment reconstitution; Derived from imputed data;
PIK	Based on known segment reconstitution; Derived from imputed data;
RA	Recipe; Approximate ingredient proportions (ex. combination of several recipes)
RC	Recipe; Cookbook
RF	Recipe; Formulary of standard products (formulary or standards of identity)
RK	Recipe; Known formulation (dissection data or proprietary formulation)
RKA	Recipe; Known formulation; No adjustments applied, combination of analytical data or aggregation of analytical data.
RKI	Recipe; Known formulation; No adjustments applied, combination of analytical data or aggregation of

	analytical data
RP	Recipe; Per package directions (e.g. refrigerated dough, toast, cake mix)
RPA	Recipe; Per package directions; No adjustments applied, combination of analytical data or aggregation of analytical data
RPI	Recipe; Per package directions; no adjustments applied, with partial analytical data or aggregation of analytical data
S	Product standard, e.g. enrichment level
T	Taken from another source-other food composition tables/databses
Z	Assumed zero
O	Other procedure used for imputing
Method Headline	
http://www.eurofir.org/eurofir/EuroFIRThesauri.asp	
Quality control QC	
RS	replicate study
RP	recovery %
RA	Repeat analysis
IHRM	Using in-house QC samples
CHART	Monitoring precision by QC-charts
CRM	Using certified reference materials
ORM	Other reference materials
PT	national/international laboratory performance study
AC	acredititation for nutrient in this food matrix
QI quality index	
A	high confidence in value
B	good confidence in value
C	medium confidence in value
D	low confidence in value
E	no confidence in value

Annex 8 : How do recipes and composite foods come to their nutritional values?

The most reliable method of identification of nutrient data is the food analysis in laboratories. However, food analyses are cost and time consuming. Therefore, calculation methods have been developed on the basis of analysis, which allow the determination of the nutrient content of many prepared foods.

There are generally two types of composite foods in food composition databases (FCDBs): recipes in the classic sense and simple processed food. Among the recipes in the classic sense there are dishes like sliced bread or a lasagne, while a simple processed food can be a grilled steak or boiled eggs. In both cases, the nutrient levels will be determined with the same method of calculation.

There is hardly any food that is not cooked in any form before consumption. Depending on the type and condition of the food and the desired end product, the required heat treatment will follow (e.g. boiling in water, frying in butter or steaming). The purpose of the preparation is to convert the food into an edible condition. The improvement of the hygienic and sensory properties of the food, an increase in the digestibility and usability (e.g. protein) and the removal of contaminants (e.g. heavy metals) are aspects, which play an important role.

The preparation, however, leads in addition to these desirable also to undesirable changes in nutritional content. Thus, by heating or boiling in water losses occur due to water-soluble and/or heat-sensitive nutrients (e.g. vitamins and minerals). If the nutrient content of a processed food product is used for the calculation of a composite food with many ingredients, these losses have to be taken into account. Two factors are used.

The **nutrient retention factor** does say something about how much of a nutrient is retained after the preparation of a foodstuff.

The **yield factor** provides information on weight changes during the food preparation, e.g. water absorption during cooking of pasta and water loss during the preparation of meat.

The Network of Excellence EuroFIR provides a proposal on the application of recipe calculation methods in handling and calculating food composition data (FCD). The following calculation is based on the EuroFIR approach for recipe calculation in FCDBs.

Steps fort he calculation of nutritional values of foods:

Step 1. Select recipe and analyse all details from cooking procedure & ingredient description Recipe: Omelette, fried Example: Nutrient: Riboflavin, determination of the riboflavin (Vitamin B2) content in Eggs Cooking method: Frying

Ingredients	**Amount in recipe**

Ingredients	Amount in recipe
Eggs	**110**
Milk	500
Salt	130
Flour	2
Oil	14

Step 2. Take suitable yield and nutrient retention factors from the datasets with recommendations and rules for the use of factors (number 1 in the literature's list, see below) Yield factor for dishes containing eggs: 0.95, nutrient retention factor for riboflavin in eggs: 0.85

Step 3: Determine the weight of each ingredient (edible part). Convert household measures if necessary

Step 4: Sum the weights of ingredients

Ingredients	Amount in recipe
Eggs	**110**
Milk	500
Salt	130
Flour	2
Oil	14

Ingredients	**Amount in recipe**
Weight, total, raw	**756**

Step 5: Apply yield factor to adjust for weight changes
= Weight, total, cooked = weight, total, raw * yield factor
= 756 * 0.95 = 718 g

Weight, total, cooked	**718**

Step 6: Find nutrient values per 100 g of raw ingredients from FCDB or other sources

Nutrient content per 100 g raw ingredient (Source: SwissFIR, swissfir.ethz.ch)

Ingredients	**Riboflavin (mg)**
Eggs	0.50
Milk	0.20
Flour	0.05
Salt	0
Oil	0

Step 7: Calculate the nutrient content per 100 g of cooked dish (Calculation of the riboflavin content of eggs in 100 g cooked dish)
= Nutrient content of ingredient per 100 g uncooked * raw weight of ingredient / total cooked weight
= 0.50 * 110 g / 718 g
= 0.08 mg

Step 8: Apply retention factor to adjust for nutrient content changes
= Nutrient content per 100 g cooked recipe * nutrient retention factor
= 0.08 * 0.85 = 0.07 mg
There is 0.07 mg riboflavin in 100 g eggs in the omelette, fried.
The correction of the nutrient content is then carried out for the rest of the ingredients and the riboflavin content in all ingredients then added. Thus, ones get the total riboflavin content of 0.21 mg in 100 g of omelette, fried.

Ingredients	**Riboflavin (mg/100 g) in raw ingredient**	**Riboflavin (mg/100 g) in cooked ingredient, before correction**	**Riboflavin (mg/100 g) in cooked ingredient, after correction**
Eggs	0.50	0.08	0.07
Milk	0.20	0.14	0.13
Flour	0.05	0.009	0.009
Salt	0	0	0
Oil	0	0	0
Riboflavin, total in 100 g omelette, fried		**0.21**	

Annex 9 : MELiSSA recipe card

Recipe Card

Identification

References

Name	
Local name	
English name	
Cooking method(s)	
Preparation time	
Cooking time	
Portions	
Portion (weight)	

Allergen	Risk	Allergen	Risk
Wheat or gluten		Mollusc	
Shellfish		Cow Milk	
Eggs		Nuts	
Fish		Celery	
Peanut		Mustard	
Soy		Sesame seed	
Lupin		Sulfur dioxide and sulfites	

Ingredients	Net Weight	Gross Weight

Material	Units	time allocated

Waste	Weight

Water	
Food wastes	

Additional information	
% of water evaporation during preparation	
% of weight loss during preparation	
% of fat soak	

Additional information	
% of MELiSSA ingredients number	
% of MELiSSA ingredients weight	

Preparation

Recipe card (continuation)

		Raw composition			Loss estimation			Estimated total		
		Total recipe	1 portion	Per 100g	Total recipe	1 portion	Per 100g	Total recipe	1 portion	Per 100g
Nutrient	Unit									
Energy	kcal									
	kJ									

Include essential nutrients

Annex 10 : 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

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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 mostly 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