



Eurofins

Carbohydrate Competence Centre: Your partner for sweet analyses

Dr. Jeroen van Soest – BU manager

Dr. Yannis Vrasidas – Scientific support manager

Santiago, Chili, 2017

Carbohydrate Competence Centre Expertise



BU Manager:

Dr. Jeroen van Soest
specialist in carbohydrates & food-feed-pharma-non-food products
PhD on starch bioplastics
> 100 publications/patents/standards in the field
winner several prizes e.g. 2 cereal prizes, bioplastic Oskar.



CCC lead scientist & co-author:

Dr. Yannis Vrasidas
carbohydrates and modification
prebiotics & dietary fibres & HMOs
pharma and food



- Eurofins Group & Carbohydrate Competence Centre
- Topic 1 9 Tuesday 9:20 - 9:40 (SESIÓN PARALELA 5SALÓN CORDILLERA)
 - Reemplazo de ingredientes críticos por fibra dietaria. Cómo la interacción de ingredientes incide en las mediciones y dificultades observadas. = Replacement of critical ingredients with dietary fiber. How the interaction of ingredients affects the measurements and difficulties observed.
- Topic 2 Tuesday 14:50 - 15:10 (SESIÓN PARALELA 9SALÓN CORDILLERA)
 - Un ejemplo: el desarrollo del método de Fibra Dietaria relacionada a alimentos funcionales con ingredientes destinados a reducir nutrientes. Polialcoholes , inulinas, edulcorantes u otros. Apoyo en la legislación Unión Europea. = **An example: Dietary Fiber methods related to functional foods with nutrient reducing ingredients, e.g. polyalcohols, inulins, sweeteners or others. Consequences for (European Union) legislation.**

- **34 employees, 28 FTE (analysts & scientists) with strong expertise in**
 - Carbohydrate, Food, Analytical Chemistry & Analysis
- **Wide portfolio of routine & specialty analyses**
 - > 80 tests - 4000 analyses / month
 - based on (inter)national standard methods (AOAC, ISO, AACC)
 - in-house methods / national and international clients
- **Development of new methods**
- **Member or active in international leading commissions**
 - AOAC / SPIFAN → recently 1st action standard AOAC (Inulin-Fructan) method with Nestle
 - ISO / IDF / NEN → developing new sugar profile with ISO-IDF & industrial partners
- **Strong collaboration with universities & technical colleges**





Fibre components

■ European Commission directive 2008/100/EC

Carbohydrate polymers with three or more monomeric units, which are neither digested nor absorbed in the human small intestine and belong to the following categories:

- Edible carbohydrate polymers naturally occurring in food as consumed
- Edible carbohydrate polymers which have been obtained from food raw material by physical, enzymatic or chemical means and which have a beneficial physiological effect demonstrated by general accepted scientific evidence
- Edible synthetic carbohydrate polymers which have a beneficial physiological effect demonstrated by generally accepted scientific evidence

This definition includes not only NSP but other non-digestible oligosaccharides such as: lignin, resistant starch, resistant maltodextrines, polydextrose, FOS, GOS etc.

Includes some prebiotics 

What ?

Markets (examples)

- **Ingredients**
- **Final products**
- **Retail**

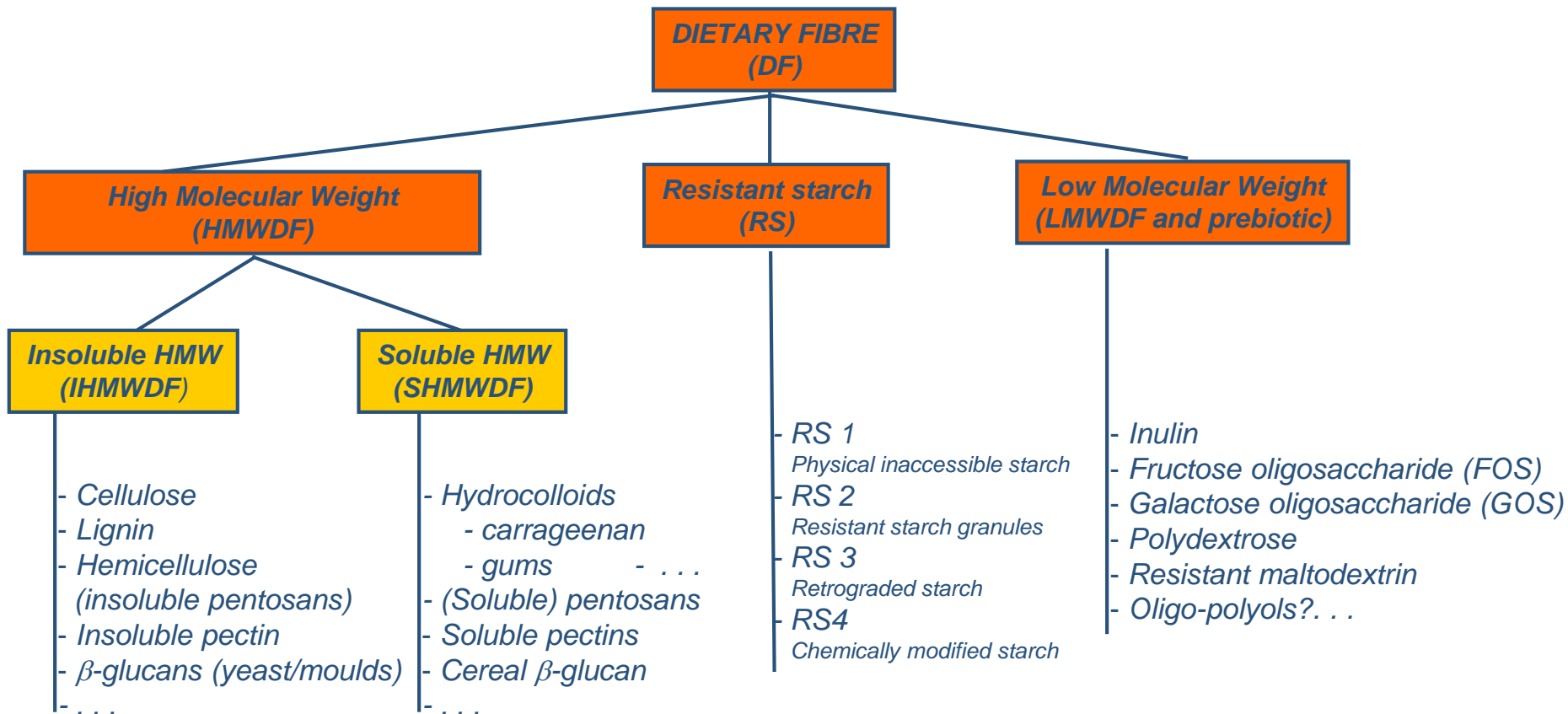


Products (examples)

- **Bakery**
- **Pasta**
- **Beverages**
- **Dairy**
- **Infant & Baby food**
- **Healthy food products**



What? Components / sources



Fibre components and sources

DIETARY FIBRE

High Molecular Weight (HMWDF)

Insoluble HMW (IHMWDF)

- Cellulose
- Lignin
- Hemicellulose (insoluble pentosan)
- Insoluble pectin
- β -glucans (yeast/moulds)
- ...

Cellulose

- Polysaccharide; Linearly arranged glucose units (up to 10000)
- Insoluble, resistant to digestion by human enzymes.
- 25% of the fibre in grains and fruit; 1/3 in vegetables and nuts.

Lignin

- Not a polysaccharide; Complex polymer of aromatic alcohols.
- Chemically bound to hemicelluloses in plant cell walls.
- Celery, outer layers of cereal grains.

Hemicellulose (insoluble pentosan)

- Water insoluble non-starchy polysaccharides.
- Heteropolysaccharide; 2-4 different sugar units.
- Arabinose, xylose, and also galactose, glucose, glucuronic acid etc.
- Associated with cellulose in cell walls.
- 1/3 of the fibre in vegetables, fruits, legumes and nuts.

DIETARY FIBRE

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Pectin

- Complex polysaccharide containing at least 50% galacturonic acid Other sugars may present: rhamnose, xylose, fucose, apiose.
- Soluble in hot water and gels on cooling.
- In cell walls and intracellular tissue of fruits and vegetables.
- Most in fruits.
- Also represents 15-20% of the fibre in vegetables, legumes and nuts.

β -Glucans (Yeasts/Moulds)

- Glucose polymers
- Part of the cell wall in certain baker's yeast, fungi and bacteria
 - Yest β -glucans: non-soluble
 - $\beta(1,3)$ -linked glucose backbone with $\beta(1,6)$ linked glucose branches

DIETARY FIBRE

High Molecular Weight (HMWDF)

soluble HMW (SHMWDF)

- Hydrocolloids
 - carrageenan
 - gums
 - guar
 - cassia
 - arabic
 - ...
- (Soluble) pentosans
- Soluble pectins
- Cereal β -glucan
- ...

Hydrocolloids (Gums)

- Hydrophilic polymers, of vegetable, microbial or synthetic origin;
- Generally contain many hydroxyl groups
- Various types of carbohydrates e.g. galactose, mannose, arabinose, xylose, anhydro-galactose etc..
- May be polyelectrolytes (e.g. gum arabic, carrageenan etc)
- Gelling agents, thickeners, stabilizers, emulsifiers.

β -Glucans (Cereals)

- Major component of cell wall material in oats and barley
 - Cereal β -glucans: soluble
 - $\beta(1,3/1,4)$ -linked glucoses (linear)

Soluble pentosans

Soluble pectins

DIETARY FIBRE

Resistant Starch

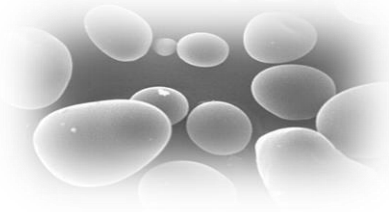
- RS 1
Physical inaccessible starch
- RS 2
Resistant starch granules
- RS 3
Retrograded starch
- RS 4
Chemically modified starch

Resistant Starch

- Starch and starch degradation products that are not absorbed in the small intestine.
- Four classes
 - RS1 Physically inaccessible starch
 - RS2 Starch granules (occurs naturally in its granular form)
 - RS3 Retrograded starch
 - RS4 Chemically modified starch

Sources

- **RS1:** Seeds, legumes (thick cell walls), unprocessed whole grains
- **RS2:** Uncooked potato, unripe bananas
- **RS3:** Produced during cooking, cooling and storage of foods (exact quantification is difficult due to cooking)
- **RS4:** Not found in nature



DIETARY FIBRE

Low Molecular Weight (LMWDF)

- Inulin
- FOS
- GOS
- Polydextrose
- Resistant maltodextrin
- ...



Inulin

- Naturally occurring polysaccharide (e.g. onions, chicory, Jerusalem artichoke etc.).
- $\beta(1,2)$ -linked fructose molecules with terminal glucose unit.
- DP>10 (up to 60 units)
- Not digestible by human enzymes



FOS (Fructo-oligosaccharides)

- Obtained from inulin by enzymatic degradation (Fm, oligofructoses)
- or
- Synthetically by enzymatic elongation from sucrose (GFn, small inulins)

DIETARY FIBRE

Low Molecular Weight (LMWDF)

- Inulin
- FOS
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- ...



Galacto-oligosaccharides (GOS)

- Produced through enzymatic conversion of lactose
- Depending on the enzyme source linkage can vary
- DP can vary markedly ranging from 2 to 8 monomeric units
- Not hydrolyzed by human enzymes
- Prebiotic.
- Used mainly in infant formulas

Polydextrose

- Indigestible synthetic polymer of glucose (randomly bonded)
- Replacement of sugar, starch and fat in beverages, cakes, breakfast cereals, salad dressing etc.
- Prebiotic benefits (shown in animal studies).

Resistant maltodextrin

- Short chain glucose polymers
- From starch by treatments with heat and/or acid and/or enzymes; Some small amounts during food processing.
- Prebiotic benefits

Definition:

“A prebiotic is a non-viable food component that confers a health benefit on the host associated with modulation of the microbiota in the intestinal track”

Prebiotics: inulin,
fructo-oligosaccharides (FOS),
galacto-oligosaccharides (GOS),
soya-oligosaccharides,
xylo-oligosaccharides,
resistant dextrin,
lactulose



Analyte	Matrix	Method based on
Inulin/FOS - Fructans	Ingredients	AOAC 997.08
Inulin/FOS - Fructans	Food	AOAC 999.03
Inulin/FOS - Fructans	Infant formula	AOAC 2016.14
Inulin/FOS – Fructans <i>Fully validated yet only as special test on request</i>	Infant formula	GB 5009.255-2016
Galacto-oligosaccharides (GOS)	Food & ingredients	AOAC 2001.02
GOS <i>Ask CCC for suitability</i>	High lactose products	AOAC 2001.02 modified
Total Sialic acid	Infant formula	in-house (HPAEC-PAD)
Polydextrose	Food	AOAC 2000.11



Dietary Fibre and health



Direct benefits of eating DF rich foods can be classified in 2 categories:

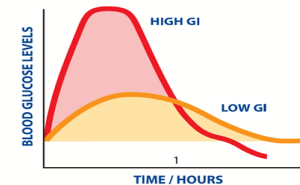
Small intestinal effects

1. Satiety and obesity
2. Glycemic index & diabetes type 2



Large intestine effects

1. Constipation
2. Blood cholesterol level & coronary heart disease



The amount of carbohydrate in the reference and test food must be the same.

Obesitas– a *big* issue for food producers, consumers, government



- **GENERAL LABELLING PROVISIONS – Directive 2000/13/EC**
- **Nutritional labeling → Council directive 90/496/EEC**
- **Quantities components**
 - Carbohydrates
 - Sugars
 - Polyols
 - Dietary fibres
 - Special products
 - Sweeteners
 - Gos-Fos infant formula
 - Energy values



- **Nutrition and health claims**
 - **Regulation EC No 1924/2006**
 - **Sugar free, DF rich, low calory,**
 - **Lactose free, no sweeteners, ...**

Key terms used in the act	
“Claim”	any message or representation, which is not mandatory under Community or national legislation, including pictorial, graphic or symbolic representation, in any form, which states, suggests or implies that a food has particular characteristics;
“Nutrition claim”	any claim which states, suggests or implies that a food has particular beneficial nutritional properties;
“Health claim”	any claim that states, suggests or implies that a relationship exists between a food category, a food or one of its constituents and health;
“Nutrients”	proteins, carbohydrates, fats, fibres, sodium, vitamins and minerals listed in the Annex to Directive 90/496/EEC , and substances which belong to or are components of one of those categories.

Group 1 label (in 6 different languages):

GB/IE	GR/CY	FI	
Nutrition Information	Θρεπτικά στοιχεία	Ravintoarvo	g/100g
Energy	Ενέργεια	Energiaa	2361 kJ/566 kcal
Protein	Πρωτεΐνες	Proteiinia	6,2 g
Carbohydrate	Υδατόνθρακες	Hiiilihydraatteja	56,3 g
Fat	Λιπαρές ύλες	Rasvaa	35,1 g
SE	DK	IT	
Näringsvärde	Næringsindhold	Informazioni nutrizionali medie	g/100g
Energi	Energi	Valore energetico	2361 kJ/566 kcal
Protein	Protein	Proteine	6,2 g
Kolhydrater	Kulhydrat	Carboidrati	56,3 g
Fett	Fedt	Grassi	35,1 g

Group 2 label:



Nutrition Information			
Typical values	per 100ml	per serving 250ml	%GDA
Energy	2kJ/<1kcal	5kJ/1kcal	<1%
Protein	trace	trace	<1%
Carbohydrate	0.08g	0.2g	<1%
of which sugars	0.08g	0.2g	<1%
Fat	trace	trace	<1%
of which saturates	trace	trace	<1%
Fibre	trace	trace	<1%
Sodium	0.01g	0.03g	1%
Salt equivalent	0.03g	0.08g	1%

GDA = of an adult's guideline daily amount
 Energy advice: see list of ingredients.

'Nutrition claim' means any claim which states, suggests or implies that a food has particular beneficial nutritional properties due to:

- **The energy (calorific value) it:**
 - (a) provides
 - (b) provides at a reduced or increased rate or
 - (c) does not provide
- **The nutrients or other substances it:**
 - (a) contains
 - (b) contains in reduced or increased proportions or
 - (c) does not contain
- **Nutrition claims are only permitted if they are listed in the Annex of Regulation (EC) No 1924/2006, lastly amended by Regulation (EU) No 1047/2012.**

Permitted nutrition claims – long list



- **LOW FAT, FAT-FREE, LOW SATURATED FAT, SATURATED FAT-FREE**
- **(VERY) LOW SODIUM/SALT, SODIUM-FREE or SALT-FREE, NO ADDED SODIUM/SALT**
- **SOURCE OF PROTEIN, HIGH PROTEIN**
- **SOURCE OF [NAME OF VITAMIN/S] AND/OR [NAME OF MINERAL/S]**
- **HIGH [NAME OF VITAMIN/S] AND/OR [NAME OF MINERAL/S]**
- **CONTAINS [NAME OF THE NUTRIENT OR OTHER SUBSTANCE]**
- **INCREASED [NAME OF THE NUTRIENT]**
- **REDUCED [NAME OF THE NUTRIENT]**
- **LIGHT/LITE**
- **NATURALLY/NATURAL**
- **SOURCE OF OMEGA-3 FATTY ACIDS**
- **HIGH OMEGA-3 FATTY ACIDS**
- **HIGH MONOUNSATURATED FAT**
- **HIGH POLYUNSATURATED FAT**
- **HIGH UNSATURATED FAT**

- **SOURCE OF FIBRE**
 - A claim that a food is a source of fibre, and any claim likely to have the same meaning for the consumer, may only be made where the product contains at least 3 g of fibre per 100 g or at least 1,5 g of fibre per 100 kcal.
- **HIGH FIBRE**
 - A claim that a food is high in fibre, and any claim likely to have the same meaning for the consumer, may only be made where the product contains at least 6 g of fibre per 100 g or at least 3 g of fibre per 100 kcal.
- **LOW ENERGY, ENERGY-REDUCED, ENERGY-FREE**
- **LOW SUGARS, SUGARS-FREE, WITH NO ADDED SUGARS**
 - Polyols no – low calories (Regulation (EC) 1333/2008) → some may be part of DF
 - Isomaltulose, D-tagatose (no calories), ...
 - DF = low calorie

- **Processed cereal-based foods & baby foods**
 - Commission Dir. 2006/125/EC

 - Infant formula requires special attention toward:
 - Dietary fibres
 - Prebiotics → Fructans, Gos, sialic acid

■ Dietary Fibres

- Important components
- Complex
- Regulation & claims
- Tests are needed to support claims

Carbohydrate Competence Centre



Analytico Food



eurofins | Food Testing
corporate brochure 2015

Thank you

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Questions