

# Cursos *e-learning* sobre Composição de Alimentos

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# Importância dos dados da Composição dos Alimentos

Sem dados da composição dos alimentos os países não podem:



Avaliar a **ingestão de nutrientes** pelas suas populações de forma a estabelecer **necessidades** de determinados **nutrientes**;

**Produzir rótulos** exatos (cálculo da informação no rótulo sobre os ingredientes é frequentemente produzida a partir de dados TCA/BDCA);

Realizar **estudos epidemiológicos** sobre as relações entre a ingestão do nutriente e a doença;

Promover **alimentos vegetais e animais** com **bons perfis nutricionais** através de programas de educação nutricional e incluí-los nos programas de melhoramento agrícola/animal;

**Formular dietas** institucionais e terapêuticas nutricionalmente equilibradas;

**Informar os consumidores** sobre **boas escolhas alimentares**.

# Princípios de utilização correta de TCA/BDCA



Que princípios devem os utilizadores aplicar para uma utilização correta de TCA/BDCA?

Devem **conhecer a influência da descrição do alimento e definição dos componentes, unidades e método analítico nos diferentes valores dos nutrientes.**

Assim, **antes de utilizar qualquer dado** de uma TCA/BDCA, um **utilizador** deve **estudar cuidadosamente a documentação** dos dados.

**Dados não documentados NÃO devem ser utilizados**

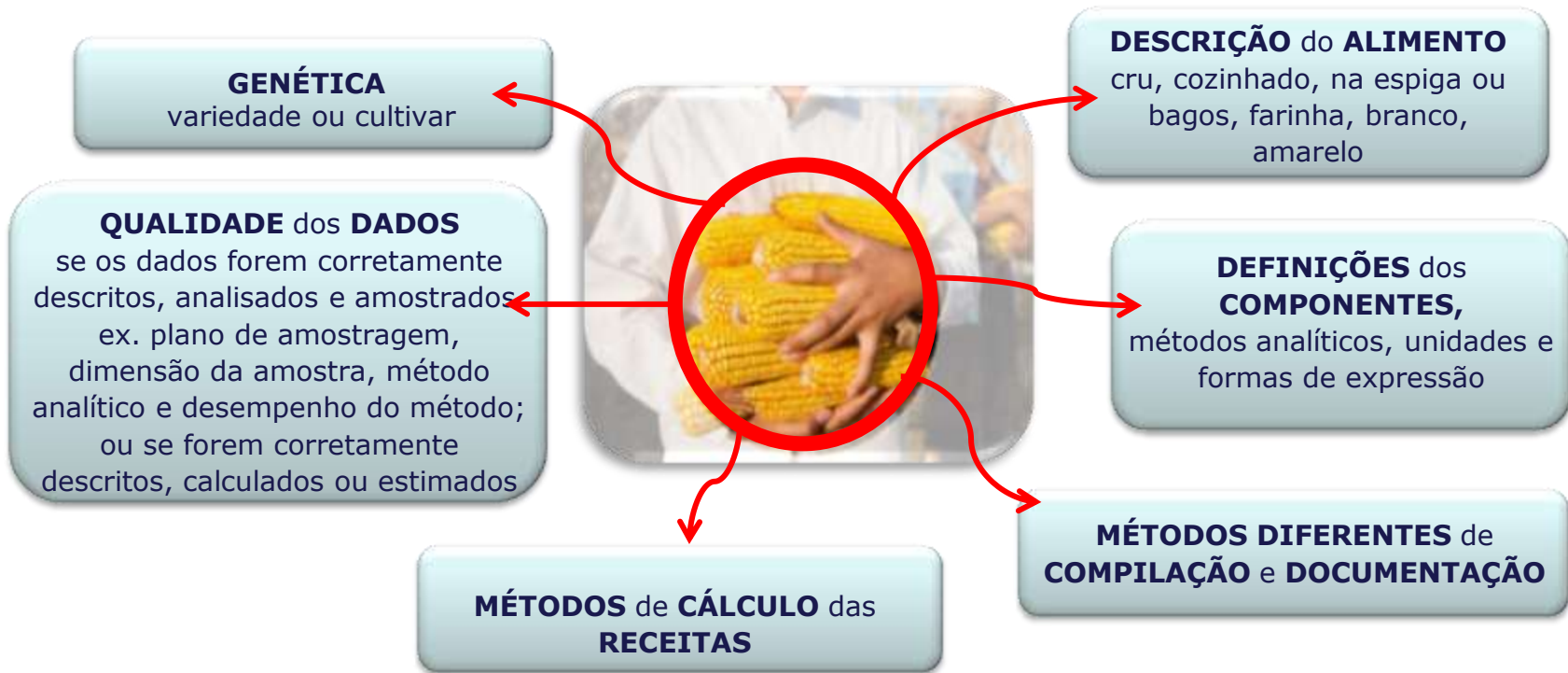


Um **utilizador avançado** é capaz de **reconhecer a qualidade dos diferentes dados** e deve ser capaz de **compilar e documentar** uma base de dados incluindo o cálculo dos **valores dos nutrientes** de alimentos cozinhados e de pratos multi-ingredientes.



# Composição dos Alimentos: o que realmente significa

Milho não é apenas “milho” em composição de alimentos.  
Os teores dos nutrientes no milho variam com:



# Guias, normas, metodologias, ferramentas

O que é necessário para gerar, administrar e utilizar dados da composição de alimentos corretamente?



Necessitamos de **guias, normas, metodologias e ferramentas** e de pessoas capazes de as aplicar corretamente. Para desenvolver uma TCA/BDCA também são necessários **dados** de composição de **elevada qualidade**.





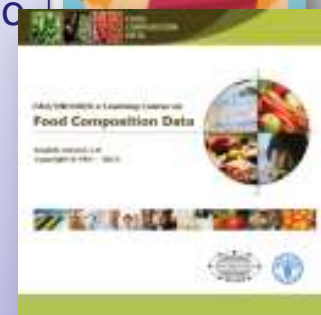
# Formação



Onde é que os profissionais podem aprender sobre dados de composição de alimentos?

Bem, há diferentes formas:

- em universidades ou escolas
- cursos de formação internacionais de composição de alimentos
- guias sobre composição de alimentos da FAO/INFOODS e do EuroFIR
- **Curso e-learning FAO/INFOODS, sobre dados de composição de alimentos, setembro 2013**
- **Cursos e-learning EuroFIR, sobre composição geral e vitaminas, 2009**



# Destinatários e Objetivos

## Destinatários

- nutricionistas,
- dietistas,
- investigadores,
- epidemiologistas,
- analistas,
- especialistas em desenvolvimento de produtos
- fabricantes,
- técnicos de planeamento agrícola,
- especialistas em segurança alimentar,
- ...

## Objetivos

Disponibilizar **conhecimento relacionado com gestão, análise e atualização de bases de dados de composição de alimentos.**

Inclui também teoria sobre alimentos, nutrientes, química, amostragem, métodos analíticos, qualidade dos dados, nomenclatura, classificação e identificação.



# Vantagens do *e-learning*

1. **Permite chegar a um público-alvo mais amplo** possibilitando o acesso de indivíduos dispersos geograficamente, é adequado para formação por conta própria e permite um estudo no local e hora mais conveniente para o utilizador
2. **Proporciona uma base de *e-learning* utilizável ao ritmo de cada um:**
  - tutoriais para aprendizagem com base em *pdf* e *Internet*
  - exercícios com várias opções / escolha múltipla
3. **Recupera-se facilmente o investimento:**
  - Custos de produção de um curso *e-learning* são muito mais baixos que os presenciais
  - *E-learning* pode chegar a milhares de indivíduos
  - *E-learning* em combinação com cursos presenciais reduz o tempo e custos dos *workshops*





# Curso *e-learning* FAO/INFOODS

- **14 lições em 5 unidades**
- Baseado no ***Food Composition Study Guide*** da **FAO/INFOODS** e outros documentos, ex. “Food composition data” de Greenfield e Southgate
- Cada lição inclui:
  - ❖ **Duração**
  - ❖ **Objetivos**
  - ❖ **Conteúdo interativo** para **utilização autónoma**, incluindo *pop-ups*, ligações a *web-sites* ou documentos PDF
  - ❖ **Exercícios** com comentários e correções das respostas
  - ❖ **Resumo**
  - ❖ **Recursos**

# Visão geral do curso

O curso tem **5 unidades** através das quais o formando aprende a utilizar os dados da composição de alimentos corretamente:



na **Unidade 1** os **objetivos** e **princípios básicos** de **TCAs/BDCAs**.



na **Unidade 2** a influência e importância da **descrição** correta do **alimento**.



na **Unidade 3** a importância da **definição** correta do **componente**, **método analítico**, **expressão**, **unidade** e **denominador** no valor quantitativo do nutriente.




na **Unidade 4** a diferenciação da **qualidade** de dados diferentes tendo em consideração a biodiversidade.



na **Unidade 5** a **compilação** e **documentação** da base de dados incluindo o cálculo dos valores dos nutrientes de alimentos cozinhados e pratos multi-ingredientes.

# Visão global e estrutura do curso


**FOOD COMPOSITION DATA**

X

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Back to Lesson

**ABOUT THIS MODULE**

Overview

Structure and Workload

Authors

About INFOODS

**OVERVIEW**

The FAO/INFOODS e-Learning Course on **Food Composition Data** will contribute to close the knowledge gap on food composition of nutritionists and all those generating, compiling or using food composition data.



The course is designed to be primarily used in universities, as it is important that future generations of nutritionists, food scientists, dieticians, chemists analysing food components, food composition data compilers, health professionals and agronomists appreciate food composition data and use them adequately in their respective fields to improve data quality, availability and usage worldwide. The course can also be used by self-learners interested in food composition, or in conjunction with food composition courses, or within institutes for capacity development in food composition.




Detailed knowledge on analytical methods will have to be acquired elsewhere; however, the course is useful for chemists who analyse components in foods. They will learn how to generate and present data that is of high quality and relevant for food composition tables and databases.

The course aims at making learners aware of all important issues; nevertheless the course cannot provide the necessary experience to become a full-fledged food composition expert. This will only come with experience and when actually working with food composition data. However, if most nutritionists and professionals working with food composition data acquired the knowledge of this course, it would make a great difference in data quality, availability and use.

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# Menu do curso

**FOOD  
COMPOSITION  
DATA**

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Additional Info
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**COURSE MENU**

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**UNITS**

1. Basic Principles of Food Composition Data
2. Food Description
3. Food Components
4. Quality Consideration
5. Compilation

**DESCRIPTION**

**Unit 1:**

This units gives an overview on what Food Composition Data is, which are its purposes and its users and it describes the basic principles to develop/build a FCT/FCDB.

**Pre-requisites:**  
This unit does not require any specific prerequisite knowledge.

Select a unit to see the list of its lessons. To start a lesson, please select the lesson from the list and press the "GO" button or **double-click** the lesson.

**LESSONS**

1.1 Introduction	✓
1.2 Food Composition Tables and Databases	✓

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# Objetivos da aprendizagem





**FOOD  
COMPOSITION  
DATA**

1. Basic Principles of Food Composition Data  
1.1 Introduction

✕

Course Menu
Additional Info

**LEARNING OBJECTIVES**

**Lesson 1.1  
Introduction**

At the end of this lesson, you will be able to:




- understand what food composition data are and their purposes;
- understand why food composition data are important;
- describe the challenges concerning food composition data; and
- outline the main issues that will be dealt with in this course.



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# Conteúdo da lição

**FOOD COMPOSITION DATA**

1. Basic Principles of Food Composition Data  
1.1 Introduction



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Additional Info

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**FOOD COMPOSITION DATA**





Food composition data describe the content of foods in terms of **nutrients** and **energy**, as well as of **non-nutrients** such as phytochemicals, bio: toxic components.

GLOSSARY X

**Food composition database**

A food composition database is multi-dimensional, i.e. a computerized format is used, allowing a comprehensive data documentation, which is stored in different files. These files contain additional information, e.g. on food description, food group, nutrient description, nutrient data, source codes, calculations, etc..., and are generated from a relational food composition management system such as Access or Oracle.



In general, these data are published through food composition tables (from now on always indicated as **FCT**) and food composition databases (from now on always indicated as **FCDB**). However, it is rare to find toxic components included in a FCT/FCDB.

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# Exercícios interativos

FOOD  
COMPOSITION  
DATA

5. Compilation  
5.3 Compilation Exercise: Archival Database

✕

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SEARCHING ANALYTICAL DATA FROM OTHER FCT/FCDB

Match each food entry in your database to a food from WL5 or indicate how you would obtain their nutrient values.




	Food for which you look for data	Source of nutrient values
	Chicken, flesh and skin, raw	Recipe calculation using data of 10225 and 10226
	Chicken, flesh and skin, grilled	10352 Chicken, flesh and skin, grilled
	Chicken, flesh only, raw	10225 Chicken, flesh only, raw
	Chicken, flesh only, grilled	Recipe calculation using data of 10225
	Chicken, skin, raw	10226 Chicken, skin, raw

Your answer is correct! For some food entries, you found the exact food match and you will, therefore, be able to take all the nutrient values from your neighbour's FCT. Some foods are not there, but you can calculate their nutrient values from the available food entries using a recipe calculation. This needs to be done in the correct proportion of flesh and skin. When copying nutrient values of mixed dishes or cooked foods, it is recommended that the data be checked for consistency against your own data. If necessary, it might be better to calculate the nutrient values in your own database instead of copying from other

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↷
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# Síntese

**FOOD  
COMPOSITION  
DATA**

2. Food Description  
2.1 Food Selection and Nomenclature

X

Course Menu

Additional Info

**SUMMARY**

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A complete food name and description is essential for food composition. These need to cover all important facets in order to distinguish the compositional differences among similar food entries.


If foods are not thoroughly described in the FCT/FCDB, users are likely to introduce errors when using the compositional data.

A FCT/FCDB should include all major foods such as raw foods, cooked foods, recipes, manufactured foods and biodiversity (if possible) - and not only raw foods.

The food selection for the FCT/FCDB should be done in collaboration with users.

Food grouping is more important for the compiler to check the data, than for the user to locate the food in the FCT/FCDB.

Each food entry must have a unique food code, preferably including the food group (and subgroup).






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# Recursos

**FOOD  
COMPOSITION  
DATA**





2. Food Description  
2.1 Food Selection and Nomenclature




X

Course Menu
Additional Info

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**IF YOU WISH TO KNOW MORE**

**Online Resources**

Charrondiere UR, Burlingame B, Berman S, Elmadfa I (2011) *Food Composition Study Guide - Questions and Exercises (volume 1) and Answers (volume 2)*. 2nd version. FAO, Rome. Module 3. Available at:  
<http://www.fao.org/infoods/infoods/training/en/>

Charrondiere UR. PowerPoint presentation on 'Food Nomenclature'. Available at:  
<http://www.fao.org/infoods/infoods/training/en/>

Greenfield H & Southgate DAT (2003) *Food composition data - production, management and use*. 2nd edition. FAO. Rome. Chapters 1, 2 and 5 (pp. 75-78). Available at:  
<ftp://ftp.fao.org/docrep/fao/008/y4705e/y4705e.pdf>

Haytowitz DB, Pehrsson PR, Holden JM (2002) *The Identification of Key Foods for Food Composition Research*. Journal of Food Composition and Analysis, 15(2):183-194. FAO/INFOODS (2012) *FAO/INFOODS Guidelines for Food Matching - version 1.2*. FAO, Rome. Available at:  
<http://www.fao.org/infoods/infoods/standards-guidelines/en/>

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# Divulgação

- Gratuito
- Versão *online* disponível no site INFOODS  
<http://www.fao.org/infoods/infoods/training/en/>
- Pedido do CD para o *site* acima



# Módulos *e-learning* EuroFIR



<http://www.eurofir.org/e-learning>

## Destinatários

Compiladores e utilizadores de informação sobre composição de alimentos que pretendam aprofundar conhecimentos sobre os princípios, pontos fortes e limitações dos métodos utilizados para determinar:

### **Análise de nutrientes (composição macronutrientes)**

Introdução

Gorduras e ácidos gordos

Hidratos de carbono e fibra

Proteínas e amino ácidos

Elementos minerais

### **Vitaminas (composição micronutrientes)**

Introdução

Vitaminas em alimentos - diferentes formas e características

Métodos – visão global

Vitaminas hidrossolúveis - Análise de vitaminas B<sub>2</sub>, B<sub>1</sub>, B<sub>6</sub>, folatos e vitamina C

Vitaminas lipossolúveis - Análise de vitaminas A, D e E

Resumo

### **Autores:**

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# Análise de nutrientes

**EuroFIR**  
European Food Information Resource
Nutrient-Analysis for non-chemists
Save and close 
Glossary


- Introduction
  - Welcome
  - Learning goals
  - Food composition databases
  - Nutrient analysis
  - Data quality
  - Overview cases
- Case 1: Fats & fatty acids
- Case 2: Carbohydrates & fibres
- Case 3: Proteins & amino acids
- Case 4: Elements

### Welcome to the EuroFIR module: Nutrient-Analysis for non-chemists


**Audience:**  
This module is intended for non-chemists who are involved in Food Composition DataBase (FCDB) programs or users of FCDBs who want to know more about the principles, strengths and limitations of analysis methods frequently used to determine macronutrient composition of foods. **Enjoy your study!**




**Case 1**  
Fats & fatty acids



**Case 2**  
Carbohydrates & dietary fiber



**Case 3**  
Proteins & amino acids



**Case 4**  
Elements

**Authors:**

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6ª Reunião Anual PortFIR, gestão da informação alimentar - presente e futuro

INSA, Lisboa, 31 de outubro de 2013

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# Introdução – metas do curso

**EuroFIR**  
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Nutrient-Analysis for non-chemists
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Glossary

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  - Food composition databases
  - Nutrient analysis
  - Data quality
  - Overview cases
- Case 1: Fats & fatty acids
- Case 2: Carbohydrates & fibres
- Case 3: Proteins & amino acids
- Case 4: Elements

### Introduction > Learning goals

<b>Case 1</b> Fats & fatty acids	<b>Case 2</b> Carbohydrates & dietary fiber	<b>Case 3</b> Proteins & amino acids	<b>Case 4</b> Elements

- To understand the principles, characteristics, strength and limitations of frequently used methods for measuring macronutrient composition of foods.
- To interpret laboratory results of food analysis and determine if these data are of sufficient quality to include them in a FCDB.
- To communicate with laboratory workers about analysis methods and results.

**Outline of the module:**  
*General introduction (study time 30 min - 1 hour)*  
 This gives a short introduction to Food Composition Data and data quality.

*Cases (study time 2 – 8 hour per case, depending on your prior knowledge)*  
 The main part of this module consists of several cases. Each case focuses on the analysis of a specific (macro) nutrient.

In the cases you will find several interactive exercises and questions which help you to understand the contents of the module. They are not intended as a kind of exam. So feel free to play around with the exercises and feel not depressed if you give wrong answers, but use your mistakes to learn from. For some exercises you need to use food composition data. Therefore it is recommended to have a food composition database at hand while studying the cases.

**Glossary**  
 The [glossary](#) contains additional explanations and definitions of several concepts mentioned in the case.

**Additional study material**  
 It is recommended to use the book 'Food composition data, production, management and use' of Greenfield and Southgate as reference. In the cases you will be referred to specific chapters of this book.  
[English part 1](#) (pdf 364Kb)

# Introdução – qualidade dos dados

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Nutrient-Analysis for non-chemists

Save and close 
Glossary

**Introduction > Data quality > Page (1/3)**

The following examples illustrate why insight into the quality of the data in a FCDB is important.

In the scheme below you can see that because of errors in food composition databases, the true (but unknown) nutrient intake of a population may differ from the nutrient intake that is observed (calculated) using food composition data.

**Total error:**

```

graph LR
    A[Consumed food (population)] --> B[Collected sample]
    B --> C[Analytical sample]
    C --> D[Analytical results]
    D --> E[Food composition values]
    E --> F[Calculated intake (observed)]
    A --> G[True intake (unknown)]
    G -.-> F
    
```

Calculated nutrient intake may be different from actual (true) intake!


These values are used in research, for dietary advice, etc

Go to the next page to study examples of the consequences of errors in FCDB on

- (1) epidemiological research results,
- (2) individual dietary advice and
- (3) public health decisions.



# Hidratos de carbono - exercícios



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Nutr

### Carbohydrates in foods

Carbohydrates are an important fraction in most foods and are a major sources of energy. In this section you will refresh your knowledge on the structure and function of carbohydrates and fibre.




Dietary carbohydrates

	CH <sub>2</sub> OH	CH <sub>2</sub> OH	CH <sub>2</sub> OH
<div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; font-weight: bold; color: #4F81BD;">Free sugars</p> <div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 5px;"> <p style="font-weight: bold; color: #4F81BD;">Monosaccharides</p> <p style="font-size: x-small;">Basic unit of carbohydrate, consisting of one sugar moiety. Most monosaccharides form cyclic structures.</p> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Galactose</div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Fructose</div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Glucose</div> </div> <div style="border: 1px solid #ccc; padding: 5px;"> <p style="font-weight: bold; color: #4F81BD;">Disaccharides</p> <p style="font-size: x-small;">Pairs of monosaccharide units.</p> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Maltose</div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Lactose</div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Sucrose</div> </div> </div>	<div style="border: 1px solid #ccc; padding: 5px;"> <p style="text-align: center; font-weight: bold; color: #4F81BD;">Sugar alcohols (or polyols)</p> <p style="font-size: x-small;">Chemically reduced sugars.</p> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Xylitol</div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Sorbitol</div> </div>		
<div style="border: 1px solid #ccc; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center; font-weight: bold; color: #4F81BD;">Oligosaccharides</p> <p style="font-size: x-small;">Chains of (3 - 9) monosaccharide units</p> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">FOS</div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Stachyose</div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Maltotriose</div> </div>	<div style="border: 1px solid #ccc; padding: 5px;"> <p style="text-align: center; font-weight: bold; color: #4F81BD;">Polysaccharides (or complex carbohydrates)</p> <p style="font-size: x-small;">(polymers of 10 or more monosaccharide units)</p> <div style="display: flex; justify-content: space-between;"> <div style="border: 1px solid #ccc; padding: 5px; width: 48%;"> <p style="font-weight: bold; color: #4F81BD;">Starch</p> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Amylose</div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Amylopectin</div> </div> <div style="border: 1px solid #ccc; padding: 5px; width: 48%;"> <p style="font-weight: bold; color: #4F81BD;">Non-starch polysaccharides (NSP)</p> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Cellulose</div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Hemicellulose</div> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Pectin</div> </div> </div> <div style="border: 1px solid #ccc; padding: 5px; width: 48%; margin-top: 5px;"> <p style="font-weight: bold; color: #4F81BD;">Other polysaccharides</p> <div style="border: 1px solid #ccc; padding: 2px; margin-bottom: 2px; text-align: center;">Glycogen</div> </div> </div>		

Right! Now this scheme gives you an overview of the classification of the nutritional important carbohydrates. (Realize that lignin is not a carbohydrate because it does not consist of sugar units. Therefore Lignin should NOT be placed in any of the boxes.) In the next question you will learn in which foods you can find those nutritional important carbohydrates.

... units  
... y  
... major  
... fibre in  
... are not  
... erefore,

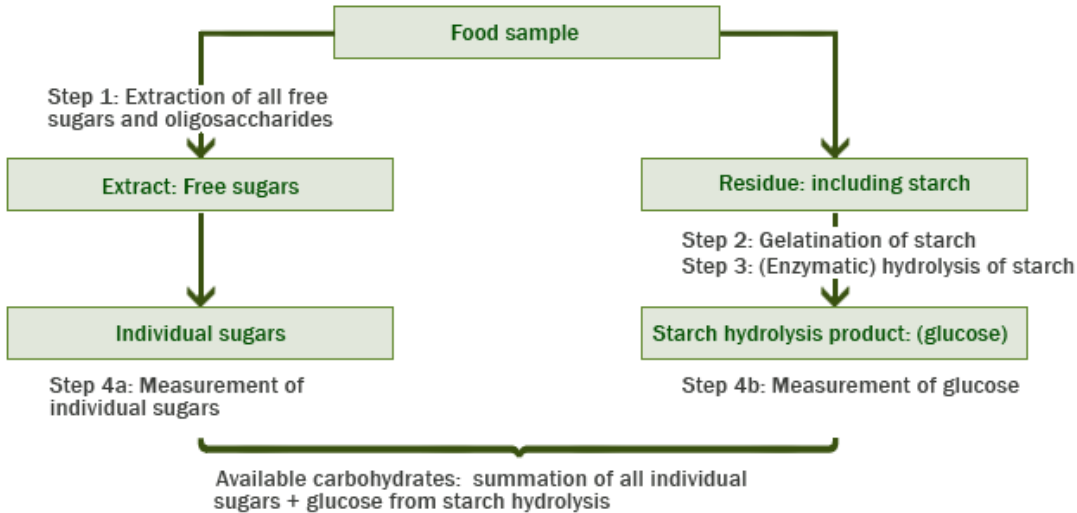
# Hidratos de carbono - métodos

 EuroFIR  
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Glossary 

- Introduction
- Case 1: Fats & fatty acids
- Case 2: Carbohydrates & fibres
  - Welcome
  - Introduction
  - Carbohydrates in foods
  - Methods
    - Total carbohydrates
      - By difference
      - Direct analysis
    - Fibre
  - Summary
- Case 3: Proteins & amino acids
- Case 4: Elements

**Case 2: Carbohydrates & fibres > Direct analysis > Page (1/7)**

Another way to determine available carbohydrates is by direct analysis. In this approach all individual carbohydrates are determined analytically and added up to obtain a available carbohydrates value. Generally this approach consists of 4 steps:



```

graph TD
    FS[Food sample] --> S1[Step 1: Extraction of all free sugars and oligosaccharides]
    FS --> R[Residue: including starch]
    S1 --> E[Extract: Free sugars]
    E --> IS[Individual sugars]
    IS --> S4a[Step 4a: Measurement of individual sugars]
    R --> S2[Step 2: Gelatination of starch]
    R --> S3[Step 3: (Enzymatic) hydrolysis of starch]
    S2 --> SHP[Starch hydrolysis product: (glucose)]
    S3 --> SHP
    SHP --> S4b[Step 4b: Measurement of glucose]
    S4a --- AC[Available carbohydrates: summation of all individual sugars + glucose from starch hydrolysis]
    S4b --- AC
            
```

Note this is a very general approach. Several variations based on this approach are possible. The next pages first focus on the subsequent steps of this general approach. Than, some attention is given to the variations in this general approach.

**Carbohydrates values determined by the general approach described above, are defined as:**

- unavailable carbohydrates
- available carbohydrates
- total carbohydrates (thus available and unavailable together).

# Hidratos de carbono - síntese

## Case 2: Carbohydrates & fibres > Summary > Page (1/2)

### Summary and additional literature

This case covered the general principles of carbohydrate and fibre analyses. Carbohydrates can be divided into several classes which each have their characteristic chemical and nutritional properties. To measure all the individual carbohydrate classes a broad range of methods should be used. Not all methods were covered in detail in this case. The literature below can be used to get more detailed insight into classification and analysis of carbohydrates.

### Overview of carbohydrate analysis methods that are often used for FCDBs:

- Greenfield and Southgate. Food composition data, production, managements and use. [Chapter 7 page 111-120](#)

### Overview papers on classification and measurement of carbohydrates:

- Cummings, JH and Stephen, AM. Carbohydrate terminology and classification. European Journal of Clinical nutrition (2007); 61 (Suppl 1), S5-S18
- Englyst, KN et al. Review: Nutritional characterization and measurement of dietary carbohydrates. European Journal of Clinical nutrition (2007); 61 (Suppl 1), S19-S39
- Monro, J and Burlingame, B. Carbohydrates and related food components: INFOODS tagnames, meaning and uses. Journal of food composition and analysis 9. 100-1108 (1996)
- Carbohydrates in human nutrition. FAO Food and nutrition paper (1997)

### For a complete overview of carbohydrate analysis and detailed technical procedures:

- D.A.T Southgate. Determination of food carbohydrates. Second edition, Elsevier Applied Science, London, 1991.



# Análise de vitaminas

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- Vitamins in foods
- Methods
- Water-soluble vitamins
- Fat-soluble vitamins
- Summary

Welcome to the case on vitamins



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# Vitaminas

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## Vitamins > Outline

### Vitamins

Vitamins are organic compounds that are required in small amounts in the diet to maintain essential body functions because humans cannot synthesize these compounds, or not in sufficient quantities.

In this case we focus on vitamin analysis. The aim is to provide you with an enhanced understanding of how vitamin content values reported in food composition databases are established.

NOTE: all of the methods for vitamin analysis discussed in this case are recommended by the European Committee for Standardization (CEN).



### Chapters

1. Introduction
2. Vitamins in foods  
In this section you will learn about different forms and characteristics of vitamins as they appear in foods.
3. Methods  
Overview of the methods and procedures used to analyse vitamins in foods.
4. Water-soluble vitamins  
Analysis of vitamin B2, B1, B6, folate, and vitamin C.
5. Fat-soluble vitamins  
Analysis of vitamin A, D and E.
6. Summary



# Vitamina E (1)

## Vitamin E

By HPLC

Vitamin E is the collective term for 8 fat-soluble compounds with similar biological activity as alpha-tocopherol.

### Present in foods as:

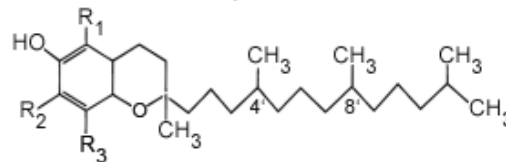
- $\alpha$ -,  $\beta$ -,  $\gamma$ - and  $\delta$ -tocopherol
- their unsaturated  $\alpha$ -,  $\beta$ -,  $\gamma$ - and  $\delta$ -tocotrienols.

### Sensitive to:

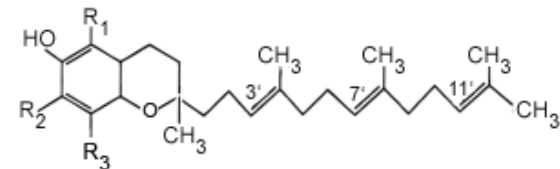
light, oxidation, heat, metals, free radicals.

Vitamin E is stable to heat and alkali (used during saponification) in the absence of oxygen.

### Tocopherols



### Tocotrienols



Trivial name	Ring position			Vitamin E activity
	R1	R2	R3	
$\alpha$ -tocopherol	CH <sub>3</sub>	CH <sub>3</sub>	CH <sub>3</sub>	1.0
$\beta$ -tocopherol	CH <sub>3</sub>	H	CH <sub>3</sub>	0.4
$\gamma$ -tocopherol	H	CH <sub>3</sub>	CH <sub>3</sub>	0.08
$\delta$ -tocopherol	H	H	CH <sub>3</sub>	0.01

Vitamin E is measured as  $\alpha$ -,  $\beta$ -,  $\gamma$ - and  $\delta$ -tocopherol.

The total vitamin E activity can be calculated by taking the sum of the individual tocopherols, taking into account the individual vitamin activity of each.

*Note that there is no consensus between different FCDB on the value and use of these individual activity factors.*

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# Vitamina E (2)

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Vitamins > vitamin E > Page (2/3)

Analytical process ▶

## Steps in the analysis of vitamin E

Depending on the food source, vitamin E samples are saponified or directly extracted and injected onto the HPLC column.



Saponification

### Extraction of oils

Oils (and fats with low water content) containing vitamin E can directly be injected into an HPLC column after dilution with n-hexane or another solvent. (this procedure applies only to samples containing unesterified tocopherols)



Extraction

### Extraction of other foods

#### 1. Saponification

The food matrix and ester bonds are broken down by alkaline hydrolysis.

#### 2. Solvent extraction

Extract vitamin E from the saponified sample by means of a suitable solvent or solvent mixture (e.g. diethyl ether, petroleum or toluene).

Then the extract is evaporated and redissolved in a solvent suitable for the HPLC system.



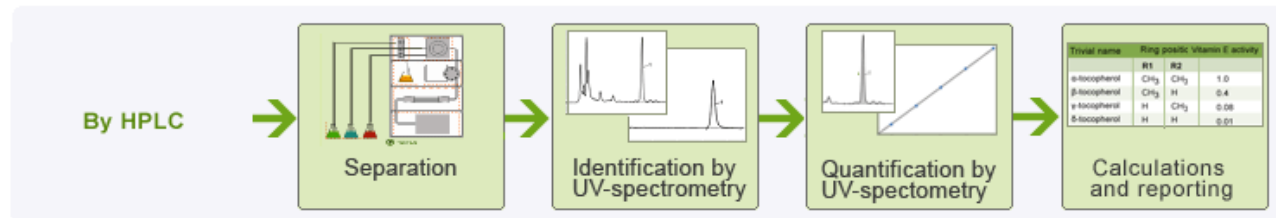
# Vitamina E (3)

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Analytical process ▶

## Determination of vitamin E



Foods may be fortified with vitamin E. Food manufacturers then use esterified alpha-Tocopherol. It is used because esterified tocopherols are more stable than the parent compounds.

A laboratory bought an oil from the supermarket and analyzed it for vitamin E content. The lab diluted the sample with n-hexane, and directly injected it into the HPLC column. The tocopherols were subsequently measured. The label of the oil claimed that it contained 140 mg vitamin E/100 g. The lab only found 70 mg vitamin E/100 g.

### 37. Which of the following statements are true?

- The label is wrong
- The oil probably contains esterified tocopherols
- An error was made in the lab, so the analysis should be repeated with the same method
- The oil should have been saponified before extraction

Submit



# Vitaminas - resumo

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- + Fat-soluble vitamins
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- **Congratulations**
- Exercises
  - Sample handling
  - Extraction
  - Determination
  - Additional steps
- Overview
- End

Vitamins > Summary > Congratulations

**Congratulations! You have finished this case, below follows a summary of what you have learned and a short quiz.**

**In this module about vitamins you have learned**

- why vitamin entries in FCDB may differ in value and in name.
- what the different water and fat-soluble vitamins are,
- in which foods they occur and which contribute most to intake.
- about vitamers, provitamins and vitamin activity

**From the methods section you have learned about**

- the considerations for choosing a good analytical method,
- challenges in vitamin analysis
- which steps are needed to analyse vitamins: from sample preparation to identification and quantification,
- which methods are frequently used for vitamin analysis and how they work,
- the analysis of water-soluble vitamins: folate, vitamins B1, B2, B6, and C, and the analysis of fat-soluble vitamins: vitamin A, D, and E.

**Additional literature:**

- Greenfield and Southgate. Food composition data, production, managements and use.
- Ronald R. Eitenmiller, W. O. Landen Jr, Lin Ye. Vitamin Analysis for the Health and Food Sciences, (Food Science and Technology), 1999 CRC Press.

Let's do a quick exercise to see how much you have learned from this module.



# Vitaminas – manuseamento amostras

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Vitamins > Exercises > Sample handling

38. Sample handling: Drag the correct analytical steps to the table to complete an overview of the analysis of each vitamin.


Vitamins	Sample handling
Riboflavin (B2)	Away from light, in a low pH environment ✓
Thiamin (B1)	Away from light, in a low pH environment ✓
Vitamin B6	Away from light and heat, in a low pH environment ✓
Folate	Away from light and oxygen ✓

Vitamins	Sample handling
Vitamin C	Away from light, heat, oxygen and metal catalysts, in a low pH environment ✓
Vitamin A and carotenoids	Away from light, heat, in a high pH environment ✓
Vitamin D	Away from light, heat and oxygen ✓
Vitamin E	Away from light, heat, oxygen and metal catalysts, in a high pH environment ✓

Right!

Submit

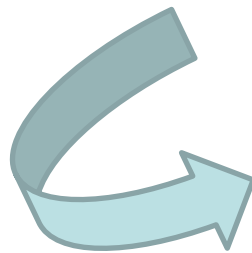


# Conclusões



Os cursos de *e-learning* são um precioso auxiliar:

- ❖ em ambiente laboral, para todos os envolvidos, direta ou indiretamente, em questões relacionadas com a composição dos alimentos;
- ❖ em universidades, para permitir que as futuras gerações tenham conhecimentos básicos sobre composição de alimentos.



Valorização da importância, disponibilidade e utilização correta dos dados da composição de alimentos.

# Obrigada pela vossa atenção!

