Dietary fibre: What is it and how to measure it correctly

Introduction

It is generally recognized that dietary fibre is an essential part of the human food. In our western world the daily intake of dietary fibre is considerably less than the recommended daily intake (about 35 g). The different categories of dietary fibre have shown to benefit amongst others diabetes, blood cholesterol levels, body weight control (obesity) and reduction of the risk of coronary heart disease.

Dietary fibre is strongly associated with natural constituents in food. However, apart from the dietary fibre which is naturally present in our food, nowadays also a whole range of a new generation industrially prepared dietary fibre products are commercially available. Many new products are launched with claims about their dietary fibre content and beneficial health effects. Manufacturers enrich their product with different types of soluble or insoluble high molar weight fibres, or low molar weight prebiotics like inulins/FOS, polydextroses, and GOS. Also resistant starch and resistant maltodextrins are considered as dietary fibre and applied in food products.

A correct measurement of the dietary fibre content is important for:
1. Correct labeling of the product
2. Decisive for granting label and health claims
3. Erroneous to low dietary fibre content is always accompanied with too high energetics value of the product

In this brochure the subdivision of dietary fibres in different categories is given, the most frequently used analytical methods for the determination of (different categories) dietary fibre are shortly discussed and a decision tree is presented in order to select the correct analytical method(s) for the determination of the total dietary fibre content.

![Diagram of dietary fibre categories and methods](image_url)
Dietary fibre definition

In principle dietary fibre is a term that refers to a group of food constituents that pass through the stomach and the small intestine undigested and reach the large intestine virtually unchanged. It is made up of indigestible parts of plants and is mainly composed of different types of non-starch polysaccharides (NSP) and lignin.

The exact definition of dietary fibre has been subject of much discussion and controversy. In 2008 the CODEX Committee on Nutrition and Foods for Special Uses updated the terminology of the dietary fibre definition. The EU adopted the definition of the CODEX Alimentarius with the remark that carbohydrate polymers in the dietary fibre should consist of at least three or more monomeric units (2008/100/EC, annex II, October 28, 2008). As visualized in the above mentioned scheme, dietary fibre constituents can be sub-divided in different categories depending on their molar weight and solubility.

Firstly, the high molar weight dietary fibres which can be subdivided again into soluble and insoluble high molar weight dietary fibers. Secondly resistant starch. Four different categories of resistant starch are distinguished, being RS1, RS2, RS3, and RS4.

And thirdly there is the category of low molar weight dietary fibres. All different prebiotics belong to this group.

The scheme shows which typical dietary fibre constituents belongs to the different categories.

Energetic value and health claims

Dietary fibres play an important role in the human nutrition. It has an energetic value of 2 kcal/g (8kJ/g). Erroneously too low established dietary fibre contents are always accompanied by erroneously too high (calculated) carbohydrate contents and thus with a too high energetic value of the product.

Depending on the total dietary fibre content and its specific constituents different health claims are allowed. Depending on the DF content, products can be claimed with ‘source of fibre’ or ‘high fibre’ (EU1924/2006). Also various health claims related to blood cholesterol, bowel function and feacal bulking are already accepted by EFSA. For this reason it is important to measure products with the right method.

Analytical methods

A lot of different methods have been applied for total dietary fibre analyses in food. Since a large number of different types of DF ingredients are nowadays available on the market. For this reason the so called Prosky method (AOAC 985.29) is not always the golden method of choice for the measurement of total dietary fiber analysis.

AOAC 2009.01 dietary fibre analysis

In the AOAC 2009.01 analysis both the total high molar weight dietary fibre (HMWDF) content, including the resistant starches RS1, RS2, RS3 and RS4 and the low molar weight dietary fibre (LMWDF) content are measured and reported. The sum of both results is the total dietary fibre content.
AOAC 2011.25 dietary fibre analysis
In the AOAC 2011.25, which is an extended AOAC 2009.01 method, a sub-division will be made between 3 categories of dietary fibres, being (1) insoluble high molar weight dietary fibres (IHMWDF) including the resistant stachses, (2), the soluble high molar weight dietary fibre (SHMWDF), and (3) the low molar weight dietary fibres (LMWDF)or prebiotics.

Classical AOAC 985.29/991.43 total dietary fibre analysis
For samples for which is known that they don’t contain low molar weight dietary fibres, it is possible to use the classical AOAC 985.29 determination of the total high molar weight dietary fibre. However one should be aware that this test excludes the resistant starch categories RS1, RS2, and RS4 and the low molar weight DF. Only RS3 will be incorporated in the test result.

Classical AOAC 991.43 total dietary fibre analysis
The same counts for the classical AOAC 991.43 determination of the insoluble and soluble high molar weight dietary fibre. This method excludes most types of the resistant starch dietary fibre.

Decision tree analytical methods
Eurofins developed a decision tree for the best choice of methodology based on what is known about the dietary fiber ingredient used in the material.
Below you will find a decision tree which allows you to choose the right method in case of several ingredients are applied in food products. The AOAC 985.29 can sometimes be used as a first result on the condition that the product/sample does not contain low molar weight dietary fibre constituents.
Some products contains by nature low molar weight dietary fibre constituents as non-starch oligosaccharides and/or inulins. In case a mixture of different dietary fibers is present in the food sample we advise always to use AOAC 2009.01 (or AOAC 2011.25).
In agreement with the new (2008) definition of dietary fibre, both with the AOAC 2009.01 and the AOAC 2011.25 analyses methods for the total dietary fibre content only the low molar weight dietary fibre constituent with DP3 and higher are quantified. This means that for example in contrast with the dedicated AOAC 2001.02 GOS analyses, the DP2 GOS constituents are not quantified with these new total dietary fibre methods. And the same is valid for the di-fructose FOS constituents. Those will only be quantified by the dedicated AOAC 997.08 inulin/FOS method and not with the AOAC 2009.01 and AOAC 2011.25 total dietary fibre methods.

**Other dietary fibre tests**

Besides these packages and tests, Eurofins Food can also perform several dedicated analyses for specific dietary fibre and/or prebiotic constituents, as for example: (branched) β-glucans from yeast and moulds, linear β-glucans from cereals (e.g. oats), total resistant starch, and the different prebiotics as inulin/FOS, galacto-oligosaccharides, polydextroses and resistant maltodextrins. For most of these tests dedicated product information sheets are available.
Overview of test codes

Advice concerning the analytical methods needed for the dietary fibre characterization of your products:

- Dedicated solutions for specific problems.
- A complete portfolio of carbohydrates testing, which cover the needs of raw materials and all food and related products
- Fast and reliable determination of the different types of dietary fibres.
- A real energetic value and a declaration on your product which contains reliable data.
- Know how and close co-operation with certification bodies, leading food industries and technical associations

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<th>Test code</th>
<th>Component</th>
<th>Matrix</th>
<th>Method</th>
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<td>HEC56, HEC63</td>
<td>Classical total (high molar) dietary fibre</td>
<td>Solid and liquid food</td>
<td>AOAC 985.29</td>
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<td>HEC69, HEC70</td>
<td>Classical insoluble (high molar) dietary fibre</td>
<td>Solid and liquid food</td>
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<td>HEC1A</td>
<td>Total dietary fibre, high molar and low molar weight</td>
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<td>HEC1B</td>
<td>Total dietary fibre, soluble and insoluble high molar weight and low molar weight</td>
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<td>Inulin/FOS</td>
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<td>β-glucan (cereals)</td>
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Publication:

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