

FAQ

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BfR MEAL Study: What's in your food?

→ BfR MEAL Study: What's in your food? This version has been revised and compared to the version of 20 October 2016

The BfR MEAL Study (Meals for Exposure Assessment and Analysis of Food) is the first large-scale study in Germany which analyses the average concentrations of substances contained in prepared foods and the health risks that can arise during the processing and preparation of these foods. The study covers more than 90 per cent of the total German diet and analyses the foods as they are typically consumed by the population living in Germany.

The BfR MEAL Study is the first Total Diet Study (TDS) for Germany. Total Diet Studies are currently being conducted in more than 50 countries worldwide. In 2015, the German Federal Institute for Risk Assessment (BfR) was commissioned by the Federal Ministry of Food and Agriculture (BMEL) to conduct the first TDS for Germany. While the experimental part of the study (field phase) has been completed, the study results are currently being evaluated and published.

In addition to other data, the results of the BfR MEAL Study serve as a basis for identifying possible health risks associated with the consumption of foods. Thus, consumption recommendations can be derived from the MEAL data. The MEAL data also form an important data basis for comparing concentrations in the event of a food crisis the concentrations of undesirable substances can be assessed quickly and reliably.

What is a Total Diet Study (TDS)?

Total Diet Study (TDS) is a method recommended by the Food and Agriculture Organisation of the United Nations (FAO) and the World Health Organisation (WHO) to determine the average concentrations of substances in the human diet. Both beneficial and undesirable substances are investigated. In combination with information from consumption studies, which determine the average consumption of foods by consumers, the TDS can be used to derive reliable and detailed mean total intakes of substances via foods.

When did the study start and who is involved?

The study started in 2015. Scientists, documentation staff, chefs, kitchen and purchasing staff worked together on the study. In addition, there was an international scientific study advisory board and expert groups for the respective groups of substances to be analysed, such as nutrients, pharmacologically active substances, process contaminants, etc. Some of the members of the expert groups are also members of the different BfR commissions. Scientists are currently evaluating the analytical results; many of these results have already been published in scientific journals.

How much did the study cost and how was it funded?

The first field phase of the BfR MEAL Study took place from the end of 2016 to 2019 and the second field phase from 2019 to 2021. A total of around 13 million euros were provided for all project participants (BfR, contract laboratories, market research institutes) over the years. The project was funded by the Federal Ministry of Food and Agriculture (BMEL) on the basis of a decision of the national parliament of the Federal Republic of Germany (Deutscher Bundestag, German Bundestag).

How long has the study been running and what are the first results?

The experimental part of the BfR MEAL Study started in autumn 2016 and was divided into two phases. In the first two and a half years, e.g., the core module, nutrients and mycotoxins, were analysed. In the second experimental phase, for example, process contaminants, food additives and substances migrating from food contact materials were investigated. The second experimental phase ended in the summer of 2021 and the results have since been evaluated and published in scientific journals. The data from the study have also been used for numerous BfR opinions and press releases. In addition, public-use files on the substance concentrations already published are publicly available on the MEAL website. A description of the study design can also be found in the final report of the BfR MEAL Study (<https://www.bfr.bund.de/cm/343/was-im-essen-steckt-abschlussbericht-bfr-meal-studie.pdf>)

Why did the study analyse prepared foods and not raw products?

The aim of the BfR MEAL Study was and is to make realistic statements about the intake of substances via foods in Germany. To do this, the foods have to be analysed as they are typically consumed – as prepared meals. During food preparation, additional substances

may occur in foods, such as so-called process contaminants (e.g., acrylamide). Other substances, such as vitamins, may vanish during preparation of foods.

Which substances were analysed in the foods?

In the BfR MEAL study, foods were analysed for both beneficial and potentially undesirable substances. The substance groups include nutrients, food additives, pharmacologically active substances, mycotoxins, pesticide residues, substances that migrate from packaging into food (substances migrating from food contact materials) and substances that are formed during food preparation (process contaminants). In addition, the extent to which the average concentrations of substances in foods differ depending on the region, season or type of production (organic or conventional) was analysed. As not all substances are expected to be present in each food, a list of substances to be analysed was drawn up depending on the relevance of the substances for each food group. This list was discussed and drawn up by the expert groups appointed for the study module. You can find a link to the list of substances [here](#).

Which foods and dishes were tested and what criteria are used to select them?

The foods are selected on the basis of existing consumption and content studies such as the Max Rubner Institute's National Nutrition Survey II for adults and the BfR's VELS study for children under the age of six. This means that the most frequently consumed foods on average are included for investigation, covering more than 90 per cent of total consumption. In addition, foods known to have high concentrations of substances undesirable to health, such as mussels, are selected from the less frequently consumed foods. Mussels are known to have high concentrations of undesirable heavy metals in the past.

What is the difference between consumption and content studies?

Consumption studies determine which foods are consumed (eating and drinking) on average by consumers. In addition, nutritional knowledge, shopping behaviour, cooking skills and other nutrition-related data are often taken into account. Body height and weight, information on physical activity and other lifestyle factors are also determined. Examples are the KiESEL study by the BfR and the National Nutrition Survey II by the Max Rubner Institute. A content study, on the other hand, analyses which substances are present in the food.

How are the meals prepared for study purposes?

The meals are prepared based on the information from the consumption studies. In addition, further surveys on consumer behaviour were conducted as part of the BfR MEAL Study, in which, for example, the kitchen utensils commonly used were also surveyed. The German Nutrient Data Base (Bundeslebensmittelschlüssel) and standard cookery books (both print and online versions) provide further relevant information on how meals are usually prepared in Germany. The meals are prepared in a specially equipped study kitchen.

How is the study organised?

The study is divided into six phases. In the first phase, the food is selected. This is followed by Germany-wide purchasing and preparation in the BfR MEAL Study kitchen. The prepared foods are then grouped (pooled), chopped and mixed (homogenised) and investigated (analysed) in the laboratory. In the final phase, the data is evaluated and the average intake of substances is calculated (exposure assessment). A graphic illustration on the phases of the BfR MEAL Study can be found [here](#).

Why are the foods pooled and homogenised?

The foods are grouped (pooled) in order to determine average concentrations and to limit the workload in the laboratory. This is especially relevant in view of the large number of substances and foods to be analysed in such studies. Pooling means that several individual foods are combined into one representative TDS pool sample before analysis. The individual foods that build up a TDS pool sample may differ e.g., based on product types (such as different brands) and forms of consumption (e.g., peeled/unpeeled fruits/vegetables). When a TDS pool sample is being compiled, these differences are taken into account according to their frequency. The prepared foods are then homogenised to ensure that the substances present in the sample are evenly distributed.

More than one pool sample can be compiled and analysed for a TDS food (e.g., apple): for example, a representative pool sample for the different regions in Germany (north, west, east, south), seasons or production type (conventional/organic farming).

Where will the results be published?

On the one hand, the results are reported to the Federal Ministry of Food and Agriculture (BMEL) and other partner institutions. On the other hand, the results are published in scientific journals and on the BfR MEAL Study website which is accessible to the public. The study data are also available to the public in form of public use files (excel files containing the concentration data for investigated substances). The public use files of substances that have already been published can be found on the MEAL study website. The [final report of the BfR MEAL Study](#), which was published in 2023, describes the entire course of the study.

What are the benefits of the study for consumers?

Consumers benefit both directly and indirectly from the study. On the one hand, recommendations for the preparation of healthy dishes are derived from the study. On the other hand, consumers also indirectly benefit from scientific research. If more information about the intake of certain undesirable substances is available, recommendations can be derived for policy makers, e.g. to correct maximum permitted levels, to check certain foods more frequently or to draw the attention of risk groups (children, elderly people, sick people, pregnant women) to any nutritional risks. If the average intake of a substance is known, the health risk of this substance can also be better determined in the event of a sudden occurrence of this undesirable substance (food crisis).

Are the results of the BfR MEAL Study only valid for Germany?

The BfR MEAL Study is the first Total Diet Study for Germany. It is based on data collected in Germany and on studies already conducted for Germany. Accordingly, the results of the study only apply to the Federal Republic of Germany.

Nevertheless, the study results are comparable with other EU countries. This was ensured by a preliminary study (TDS exposure), in which 25 European institutions in 19 EU member states were involved next to the BfR. In the preliminary study, uniform scientific standards were developed to improve the comparability of the study results.

How widespread are TDS studies?

To date, more than 50 countries worldwide have conducted a Total Diet Study (TDS). Particularly noteworthy in Europe is France, which, alongside Germany, is currently the most methodologically complex study. Representatives of the US, Canadian and New Zealand TDS were also represented in the scientific advisory board of the BfR MEAL Study.

What is Exposure assessment?

Exposure assessment determines the average amount of a substance or microorganism that consumers ingest via foods, consumer products or chemicals (i.e., the extent to which they are exposed to the substance). The estimate is based on data about which substances are present in which concentrations in foods or products. The substance concentrations in foods are determined by the BfR MEAL Study. In addition to concentration data, data on the consumption behaviour of foods and products is required. This is determined, for example, in consumption studies for foods. The average intake of substances via foods can be derived from these two data bases.

Exposure assessment builds the basis for the assessment of a health risk: The risk assessment takes into account the hazard potential of a substance or microorganism on the one hand and its average intake (exposure) via foods or products on the other. The BfR is developing new methods for exposure assessment in order to have reliable data for the necessary risk assessments. This requires both standardised, simple screening methods and modern statistical methods.

How does the BfR MEAL Study differ from food monitoring?

Food monitoring is performed by the food monitoring authorities. During food monitoring food samples are collected with the aim to successfully detect maximum content exceeding's. For this, i) food monitoring focuses on unprocessed raw materials and foods and ii) concentrates on foods for which legal maximum content levels have been set in order to check their compliance.

The BfR MEAL Study provides an indispensable extension of the data already available in Germany from food monitoring with regard to substances that have not yet been analysed (>100 substances that have not yet been covered by monitoring).

On the basis of these additions, total intakes from foods, for adults and children, can be determined for the first time for many substances, such as iodine, molybdenum and

vanadium, for which no or only sporadic data from food monitoring was previously available.

For other substances such as dioxins, dl-PCBs and ndl-PCBs, it has now been possible to extend the concentrations already known to almost all foods relevant for children and adults.

Both programmes and their resulting data sources, from the BfR MEAL Study and from food monitoring, shed light on different aspects of exposure. The BfR MEAL Study and the food monitoring therefore complement each other and, when used together, lead to a relevant strengthening of food safety in Germany. Both data sources will also be used by the BfR for exposure assessments in the future.

What opportunities for cooperation with the BfR MEAL Study exist?

As part of the BfR MEAL Study, successful cooperations were carried out with the Federal Office for Radiation Protection (BfS, measurement of radionuclides), the Max Rubner Institute (MRI, measurement of the extended nutrient spectrum), the Fraunhofer Institute for Molecular Biology and Applied Ecology IME (measurement of precursors of perfluorinated alkyl substances), and several universities. Samples from the BfR MEAL Study are kept in long-term storage, enabling cooperation in various subject areas in the future.

Further information can be found at: [www.bfr-meal-studie.de /](http://www.bfr-meal-studie.de/)
<http://www.bfr-meal-studie.de/en/meal-homepage.html>

Final report of the BfR MEAL Study: What's in your food:

<https://www.bfr.bund.de/cm/343/was-im-essen-steckt-abschlussbericht-bfr-meal-studie.pdf>

Infographic: The BfR MEAL Study: What's in your food

http://www.bfr-meal-studie.de/cm/343/MEAL_Infografik_EN_web.63072354.pdf

List of substances analysed in the BfR MEAL Study

https://www.bfr-meal-studie.de/cm/343/Stoffliste_Deutsch_2023_web.pdf

Food list of the BfR MEAL Study

https://www.bfr-meal-studie.de/cm/343/Lebensmittelliste_Deutsch_2021_Web_bf_final_1.pdf

Key messages of the BfR MEAL Study

https://www.bfr-meal-studie.de/cm/343/A4_Kernaussagen_Deutsch_2022_web_bf_final.58083204.pdf

Public use files

<http://www.bfr-meal-studie.de/en/public-use-file-en.html>

Scientific publications on the BfR MEAL Study:

https://www.bfr-meal-studie.de/en/expert_information-202151.html

BfR communication no. 028/2016: The BfR MEAL Study - Information and cooperation

<https://www.bfr.bund.de/cm/349/bfr-meal-study-information-and-cooperation.pdf>

Information on the KiESEL study of the BfR

https://www.bfr.bund.de/en/kiesel_the_childrens_nutrition_survey_to_record_food_consumption-260123.html

Information on the VELS study of the BfR

http://www.bfr.bund.de/cm/343/bfr_entwickelt_neues_verzehrsmodell_fuer_kinder.pdf

Information on the EsKiMo study by the Robert Koch Institute

http://www.rki.de/DE/Content/Gesundheitsmonitoring/Studien/Kiggs/Basiserhebung/Eskimo/eskimo_node.html

Information on the Max Rubner Institute's National Nutrition Survey II

<https://www.mri.bund.de/en/institutes/nutritional-behaviour/research-projects/nvsii/>

Information on the preliminary study TDS Exposure

<http://www.tds-exposure.eu/>

About the BfR

The German Federal Institute for Risk Assessment (BfR) is a scientifically independent institution within the portfolio of the Federal Ministry of Food and Agriculture (BMEL) in Germany. The BfR advises the Federal Government and the States ('Laender') on questions of food, chemicals and product safety. The BfR conducts independent research on topics that are closely linked to its assessment tasks.

This text version is a translation of the original German text which is the only legally binding version.

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