



The National Food Institute conducts risk assessments of chemical substances and micro-organisms - and develops new tools for assessment of the risks to which humans are exposed.
 Gelelectrophoresis. Mikkel Adsbøl

Foods we can trust

Foods may contain substances that can have a harmful effect on our health. The National Food Institute assesses risks that can be found in the entire 'from farm to fork' chain to ensure the safety of food so that neither Danish nor international consumers will get sick from the food they eat.

Foods contain important nutrients, which are necessary for our health. However, foods can also contain harmful chemicals, such as pesticide residues, process contaminants, natural toxins, heavy metals, and disease-causing microorganisms such as Campylobacter and Salmonella. Therefore, it is very important that we as consumers can safely eat the foods we buy from the shops.

When the authorities, for example, recall smoked salmon from the supermarkets because listeria has been detected in the product, researchers at the National Food Institute have analysed the bacteria and forwarded the result to the authorities.

Danish results reverberate throughout Europe

Denmark has a proud tradition for close collaboration between authorities, researchers, industry, and stakeholders to improve food safety. This not only promotes a feeling of security among Danish consumers, it also reverberates throughout the world, where Danish foods and Danish expertise are in great demand. Based on their great expertise, four employees at the National Food Institute have been appointed to participate in the expert panels of the European Food Safety Authority (EFSA).

"The spirit of collaboration in the area of food safety, which is unique in the Nordic countries, works very well in Denmark, where this collaboration also contributes to a high level of credibility," Head of Division Flemming Bager says. He emphasizes that the Institute's advisers are often involved in complicated assessments, which in some cases may have a significant financial impact on the industry.

"Thus, a high degree of professionalism and professional self-confidence is required when conducting risk assessments, and basing the recommendations on scientific evidence generates credibility - both in Denmark and in Europe," Flemming Bager adds.

Access to data is crucial

For many years, Denmark has had a science-based approach to food safety and was a first mover by publishing a positive list of approved food additives. This became a model for the much later positive list which the EU published in the 1990s. It was the forerunner of the Institute, the National Food Institute (Statens Levnedsmiddelinstitut), which prepared the Danish positive list back in 1973, based e.g. on an assessment of the harmful effects of different substances. Thus, the proud traditions go way back.

Analytical infrastructure brings all food molecules into focus

The National Food Institute has an analytical infrastructure available for chemical food analysis, which is part of the national and European contingency plan for chemicals in food.

Generally speaking, the analytical infrastructure can quantify all small molecules and other biological matrices, including vitamins, fatty acids, trace elements, and nanoparticles. Particularly, the focus is on detection of substances which have an impact on people's health.

The infrastructure is based on the fact that the Institute has more than 20 modern mass spectrometers at its disposal. Along with chromatography - a technique that separates substances in a sample - and procedures for sample purification, the mass spectrometers serve as the backbone to provide detailed, reliable, and accurate data on the chemical composition of food. Moreover, the Institute analyses degradation products caused by lipid oxidation in oils and foods. Lipid oxidation can destroy

taste and smell due to oxidative rancidity and have negative health effects.

In addition, the Institute's analytical infrastructure can determine the authenticity of foods by means of isotope ratio mass spectrometry, determine nanoparticles by means of e.g. ICPMS, and study biochemical effects in cells and organisms via metabolomics.

The National Food Institute is accredited by DANAK (the national accreditation body in Denmark) in accordance with the standard ISO 17025 for a wide range of food chemical analyses and is accredited for the provision of proficiency testing in accordance with the standard ISO 17043. This is crucial to the Institute's function as a national reference laboratory for most unwanted substances in foods and as the EU reference laboratory for pesticides in grain and feeding stuff, for processing contaminants in foods, and for metals and nitrogenous compounds in feed and food.

As they did back then, the researchers at the National Food Institute are still dependent on solid up-to-date data on population groups' food intake, the nutrients in foods, and exposure to chemicals and disease-causing microorganisms in food. In 1995, DANMAP was initiated. The programme, which collects data from all parts of the 'from farm to fork' chain, monitors the use of antimicrobials and the occurrence of antimicrobial resistance among bacteria in animals, humans, and foods in Denmark.

The National Food Institute is also responsible for the QSAR database, which was developed in cooperation with the Danish Environmental Protection Agency. The QSAR database contains information about the properties and harmful health effects of chemical substances.

Denmark separates assessment and management

Risk analyses are a recognized global tool, which the authorities use to protect public health. A risk analysis consists of three elements: risk assessment, risk management, and risk communication.

In Denmark, we have a long tradition of separating risk assessment and risk management. This separation became even more pronounced in 2007 when the Danish university reform merged the Danish Institute for Food and Veterinary Research with DTU. Thanks to this clear separation, Danish risk assessments have a high degree of credibility - also abroad.

The National Food Institute conducts risk assessments within the area of food while the Ministry of Environment and Food of

RISK ANALYSIS



Denmark, The Danish Environmental Protection Agency, and the Danish Veterinary and Food Administration are responsible for managing the risk. The National Food Institute and the authorities jointly communicate about the risk - e.g. if there are problems with *Campylobacter* or *Salmonella* bacteria in chickens.

In addition to risk assessments of foods, the Institute also carries out tasks for the Danish Environmental Protection Agency in relation to risk assessments of substances in drinking water, soil, and air, as well as writing comprehensive toxicological reports. These contribute to the Danish Environmental Protection Agency's work within the EU in relation to the approval of chemicals.

Constant focus on foods

A risk assessment is often based on the fact that a specific food is suspected of containing harmful substances or bacteria. Consumers have experienced such cases e.g. in relation to listeria in 'rullepølse' - a Danish cold cut made from pork - or salmon, which were quickly recalled from the supermarkets.

Another model for risk assessment is to explore how chemical substances affect the human body. An example is inorganic arsenic, which is found e.g. in rice. In 2009, EFSA decided that inorganic arsenic is toxic at lower doses than previously thought.

National food databases are rich in knowledge on food and health

The National Food Institute's databases are the Institute's most significant research capital and a cornerstone of the consulting services it provides to authorities and the risk assessments it prepares. The databases consist of a number of unique datasets that contain long time series with great methodological consistency. The central databases focus on:

- Danes' intake of food and nutrients
- Nutrient content of foods
- Chemical contaminants in foods
- QSAR predictions for health effects of chemical substances
- Assessment of plants, fungi, or parts thereof in food supplements and herbal tea
- Zoonosis, bacteria, and antimicrobial resistance.

This finding caused the researchers at the National Food Institute to take another look at rice and rice products as they are a significant source of inorganic arsenic, and many Danes eat rice from a very early age.

The intake of rice in Denmark is estimated to be so high that it may cause a small increase in the risk of developing cancer in the lungs, urinary bladder, and the skin. In the end, Danes were advised that the risk of cancer exists, but it is small. As such, you do not have to avoid eating boiled rice as long as it is part of a varied diet. Danes can lower the risk further by washing the rice and/or boiling it in surplus water.

Risk assessment lets Denmark enjoy special status

Sliced cold cuts of processed meat is a mainstay of a Danish

lunch. Due to our love of sliced meat, Denmark has had a set of rules since 1973 which state that the level of nitrite used to preserve the shelf life of sliced meats must be as low as possible. Nitrite impairs the growth of disease-causing bacteria such as *Clostridium botulinum*, which can cause botulism (also known as 'sausage poisoning' - caused by a neurotoxin that can paralyze the muscles). Thus, nitrite serves an important function in the products. However, the challenge is that nitrite can form small quantities of nitrosamines, which can be carcinogenic.

Despite the fact that the regulation regarding the use of nitrite in processed meat has been harmonized in the EU, Denmark has been allowed to keep its national regulation - both with respect to products manufactured within the country's borders and the products we import.



By collecting and analyzing large amounts of data on dietary intake, nutrients, pesticides, and other chemical substances, the National Food Institute can assess both the nutritional value and possible risks from eating different foods.

Apple. Colourbox



By monitoring the presence of disease-causing microorganisms and antimicrobial resistance in the food chain, the National Food Institute can carry out risk assessments and advise the authorities on ways to manage these risks.

Campylobacter. Mikkel Adsbøl

“The ambition is that the Danish consumers, with a few clicks, can collect useful information about the advantages and disadvantages of eating foods from the supermarket shelves. Therefore, the National Food Institute would like to explore how we can make such data easily accessible and useful for the Danish consumers in the future.”

Flemming Bager
Head of Division