



Newly identified biomarkers provide information about what we eat

In the **FOODBALL** project, several research teams laid the groundwork for the advancement of nutritional metabolomics. This innovative method is based on the analysis of biochemical molecules in the human metabolism that are linked to nutrition – so-called dietary biomarkers. The international consortium identified new biomarkers for various foods and defined procedures and standards for the quantitative measurement of these metabolic products in the human organism. In addition, the researchers developed approaches based on dietary biomarkers that could be used to characterise the health risks faced by individual consumers. All the results obtained in the project are available on freely accessible online platforms.

Most scientific studies on nutrition are based on questionnaires or food diaries. As the information on what the surveyed people eat is provided by the people themselves, the results obtained with these methods are often inaccurate and incomplete. Metabolomics, on the other hand, promises to generate information that is more objective and reliable. Within nutritional science, this innovative method is based on the measurement of substances that are produced when food is metabolised. Overall, these substances are known as di-

etary biomarkers. Such biomarkers can be traced in blood and urine after eating. However, these metabolic products had only been identified for very few foods and had not been systematically classified until now. In the context of the **FOODBALL** research project (The Food Biomarkers Alliance), an international research group devised strategies for measuring and interpreting dietary biomarkers. Their goal was to establish methodological principles for future nutritional studies.

Successful search for biomarkers

In a first step, the research team sifted through the existing scientific literature to find molecules that were already known or thought to be potentially suitable for use as dietary biomarkers. But they found only very few metabolites that clearly showed which foodstuffs had been consumed. This situation led the researchers to develop strategies for identifying new biomarkers in blood and urine samples using innovative methods.

Their search was successful: they were able to classify a number of metabolic products from which the consumption of specific foods could be inferred. For example, researchers from Agroscope and the University of Lausanne who participated in “**FOODBALL**” were able to identify biomarkers in the human metabolism that provide

Galactose and lactose are among the molecules produced when dairy products are digested in the human body.



evidence of the consumption of milk, cheese and soy drinks. Molecules produced when dairy products are digested include galactose and lactose.

Challenging quantitative analysis

Another goal of the project was to develop methods for the quantitative analysis of dietary biomarkers. This allows researchers to determine the quantity of a particular biomarker found in an organism. Based on the quantities of biomarkers found in the blood and urine, researchers can infer the amount of a specific foodstuff consumed. Developing a reliable procedure to quantify specific metabolites proved to be difficult, however. The main reason for this lay in the lack of uniform standards. In addition, the scientists needed to measure a combination of biomarkers in order to precisely determine the consumed foods, as people generally ingest various nutrients at the same time. The consumption of specific foodstuffs can therefore only be ascertained by looking at a combination of different metabolites.

The “FOODBALL” researchers also studied how metabolomics could improve our understanding of specific disease patterns and health risks. The teams working together on this project made substantial advances in this area and came up with promising approaches. However, there are still knowledge gaps to be filled in the area of health risk analysis.

Further information:
www.nrp69.ch

A European collaboration

The “FOODBALL” project is part of the EU Joint Programming Initiative “A Healthy Diet for a Healthy Life”. Scientists from 22 research teams from nine European countries, Canada and New Zealand worked together on this programme. The research work in Switzerland was funded under NRP 69.

Transferring basic knowledge

An important part of the “FOODBALL” project involved preparing and making available the sources and data the researchers had drawn on. Urinary and blood metabolites derived from the ingestion of several foods were published on open-access platforms. Moreover, a new index of identified biomarkers was created in an online database that can be used by future studies in nutritional epidemiology. Finally, the researchers created guidelines for measuring dietary biomarkers with modern methods and instruments. They made these guidelines available free of charge on a web portal. This information, available on the various “FOODBALL” platforms, can serve as a basis for further basic research on nutritional metabolomics.

Recommendations

Exploiting the potential of metabolomics

The results of the “FOODBALL” project clearly show that biomarkers can contribute to the development of precise nutritional recommendations in the future. Based on their results, the research teams involved in “FOODBALL” recommend examining new dietary biomarkers. In addition, the analytical stand-

ards for the most promising metabolic products need to be further expanded. Future research work should focus on quantitative analysis in particular. Moreover, it is necessary to continue pursuing innovative methods for assessing the interactions between metabolic products and health risks.