BfR

Bundesinstitut für Risikobewertung

Risks of disease from microbial pathogens in food can be predicted more quickly

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A team of researchers at the German Federal Institute for Risk Assessment (BfR) has developed a new open data format, which allows to efficiently exchange mathematical models and simulation data from the food safety domain. Mathematical models play an increasingly important role in the health risk assessment of pathogens in food. The 'Food Safety Knowledge Markup Language (FSK-ML)' format allows to uniformly document mathematical models and model-based simulation results, and make these available to other researchers for computer-based forecasts or further optimisation of models. With FSK-ML, even models which were developed in different programming languages can be exchanged in a harmonized format. For the first time, it is possible to integrate suitable models from other scientists into in-house calculations, simulations and assessments at the push of a button. Also, simulation results are transparent to others, as the used software code and all model parameters are visible to everyone and thus, results can be recalculated.

The FSK-ML information exchange format, which was extended and tested by the BfR under the AGINFRA+ project (2017-2019), allows to better and more quickly assess human health risks in the future. This means that previously developed predictive models can now quickly be calculated with different simulation scenarios and adapted to fit the issue at hand – whether it concerns the risk of salmonella in fresh eggs, or a possible transmission of *Campylobacter* germs from raw chicken breast fillet to green salad in the kitchen.

The new FSK-ML data standard also makes it easier for researchers to make their results available in accordance with the FAIR data principles (findability, accessibility, interoperability and reusability). In particular, the support of the FAIR data principles means that data and information can be found, accessed and used by different software solutions in a long-term manner.

With the development of the FSK-ML information exchange format, the BfR provides the basis for the future digitalisation of risk assessment. With FSK-ML, software developers in the food safety domain can now easily expand their current and future tools to include new functions for importing and exporting models. FSK-ML also represents the basis for the development of web-based model databases, where researchers from different disciplines can search for established models or even share their own models. One example of such a model database is the 'RAKIP_portal' (https://aginfra.d4science.org/web/rakip_portal/catalogue), developed in the AGINFRA+ project. Models, which can be made available and downloaded via this online platform, can then be used in different software tools on in-house computers or on other online platforms.

The use of FSK-ML models on one's own computer is for example possible by the open source software named "FSK-Lab" (https://foodrisklabs.bfr.bund.de/fsk-lab/) that was also developed by the BfR. In-house and external models can be imported, exported, edited, joined and even run with this intuitive software. In this way, each user can set up their own predictions or simulation calculations. There is also an extension named "FSK2R" for the open source scripting language R, which was previously presented at an international conference (esa.ipb.pt/icpmf11/welcome) in 2019.

Moreover, there are already scientific journals, such as the Food Modelling Journal (FMJ) (https://fmj.pensoft.net/), which enable FSK-ML compliant models to be imported with all rel-

evant metadata. For example, an 'executable model paper' can be automatically generated in the FMJ in this way. The presented model is not only downloaded, but is also calculated online with user-defined input parameters. Such innovative digital solutions make a significant contribution to increase the transparency and reproducibility of scientific work, as the results presented in the article, e.g. in the review process, can be tested effectively. Moreover, the models contain all relevant metadata, such as the range of applicability.

Further information on the BfR website

Link to FSK-ML standard
https://foodrisklabs.bfr.bund.de/fsk-ml-food-safety-knowledge-markup-language/

Link to FSK-Lab software
https://foodrisklabs.bfr.bund.de/fsk-lab/

Link to RAKIP_portal model catalogue
https://aginfra.d4science.org/web/rakip_portal/catalogue

Link to AGINFRA+ project
http://plus.aginfra.eu/

BfR "Opinions app"

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. It advises the German federal government and German federal states ("Laender") on questions of food, chemical and product safety. The BfR conducts its own research on topics that are closely linked to its assessment tasks.

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