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## Preparation of Dutch food consumption data for risk assessment

National Institute for Public Health and the Environment (RIVM), the Netherlands  
K Nelis and C van Rossum

### Abstract

The availability of detailed and high-quality food consumption data collected at an individual level is essential for assessing the exposure to potential risks in the food chain. During the years 2012–2016, the Dutch National Food Consumption Survey was conducted in the Netherlands as part of the EU Menu survey, following the EFSA 2009 guidance on 'General principles for the collection of national food consumption data in the view of a pan-European dietary survey'. Complete results were obtained for 4,313 persons aged 1–79 years (response rate 65%). The work programme proposed to the European Food Risk Assessment (EU-FORA) Fellow included FoodEx2 mapping of the Dutch food consumption data and preparing the final scientific report for EFSA as well as analysing habitual intake of nutrients using the SPADE programme. Further activities were added, such as performing a literature search as to the validity and usability of mobile applications for collecting food consumption data and exploring methods for estimating added-sugar/free-sugar intake.

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**Correspondence:** eu-fora@efsa.europa.eu

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## 1. Introduction

The availability of detailed and high-quality food consumption data collected at an individual level is essential for assessing the exposure to potential risks in the food chain. The collection of accurate and harmonised food consumption data at a European level is therefore considered a primary long-term objective for the European Food Safety Authority (EFSA, 2014). In 2009, the EFSA guidance on 'General principles for the collection of national food consumption data in the view of a pan-European dietary survey' was published, and a pan-European food consumption survey, also known as the 'EU Menu', was launched (EFSA, 2014).

During the years 2012–2016, the Dutch National Food Consumption Survey (DNFCS) was conducted by the National Institute for Public Health and the Environment (RIVM) as part of the EU Menu survey. For it, a random sample was drawn from consumer panels stratified by age and gender, and representative of the population with regard to region, address density and educational level. Complete results were obtained for 4,313 persons (response rate 65%) including toddlers, children, adolescents, adults and elderly. Food consumption data were collected by means of two non-consecutive 24-h dietary recalls conducted by trained dietitians; for participants aged 1–8 and 71–79 years, this was done in combination with a food diary. The dietary recalls were conducted using the computer-directed interview program GloboDiet (formerly EPIC-soft<sup>®</sup>) provided by the International Agency for Research on Cancer (IARC, Lyon, France).

To fully utilise the collected data and make it available to EFSA as well as other researchers working on risk assessment, the data had to be cleaned and coded in a common classification and description system. Alongside the food consumption data, a scientific report on the methodology of the survey needed to be provided to EFSA. These tasks, together with analyses of habitual nutrient intake from foods and supplements, formed the core of the work programme proposed by the RIVM to the Fellow. Further activities carried out by the Fellow during the European Food Risk Assessment (EU-FORA) year included performing a literature search on validity and usability studies concerning mobile applications used for recording food intake and exploring methods for estimating added-sugar/free-sugar intake. Some activities are ongoing and will be finalised after submitting this report.

## 2. Description of work programme

### 2.1. Aims

The aim of the proposed work programme was to prepare the Dutch food consumption data for risk assessment. The Fellow was placed at the RIVM, in the team working on the DNFCS. The Fellow worked with members of the team on the following tasks:

- Mapping food codes recorded in the final version of the national food consumption database to the EFSA food classification system, FoodEx2.

FoodEx2 is a comprehensive food classification and description system aimed at covering the need to describe food in data collections across different food safety domains (EFSA, 2015). The system consists of a large number of individual food items aggregated into food groups and broader food categories in a hierarchical structure of parent–child relationships, which may be complemented with additional information through the use of facets and facet descriptors (EFSA, 2011). The ability to capture all the useful details of food groups in exposure assessments by EFSA is a crucial requirement for the process of risk assessment (EFSA, 2015).

- Preparing a final DNFCS scientific report for EFSA, including an evaluation of the adaptation of the methodology according to EFSA guidance for national dietary survey data collection.

In 2009, EFSA published guidance on the general principles for collection of national food consumption data in the context of a pan-European dietary survey (EFSA, 2009) that has provided the basis for the quality criteria for EFSA's food consumption data collection (EFSA, 2014). To further improve the harmonisation of food consumption data collected in Europe, EFSA initiated a project 'What's on the Menu in Europe? (EU Menu)' in 2009. To make it possible to evaluate the success of the harmonisation efforts, it is considered important that the reporting of the results is also harmonised (EFSA, 2014).

- Performing data analyses to estimate habitual intake from intake measured on specific days using the SPADE programme, and preparing reports and scientific article(s) from the DNFCS findings concerning food consumption and dietary intake.

SPADE is a program in R (R Development Core Team, 2011) developed at RIVM for estimating the habitual intake of dietary components (e.g. micronutrients, macronutrients, contaminants) or food (groups) from repeated short-term dietary intake data. In addition to the basic modelling of daily and episodic consumption, SPADE applies a first-shrink-then-add approach to combine the intake from different sources to overcome problems with multimodality and heterogeneous variances (Dekkers et al., 2014).

The wider objective of the work programme was to give the Fellow more insight into how the data from the DNFCS is used in different fields of food safety risk assessment at a national and international level and to provide the opportunity to work with the Dutch experts in these fields.

## 2.2. Activities

### 2.2.1. FoodEx2 mapping of the DNFCS data

To provide EFSA with the food consumption data collected during the DNFCS, a process of FoodEx2 mapping had to be carried out. The Fellow was involved in team meetings with the people working on mapping and data cleaning. She presented the FoodEx2 mapping procedures used in her home institute and advised the team on some of the more challenging issues. One of the issues included finding a more efficient way of matching the highly detailed and therefore long list of unique foods from the Dutch national food composition database with the corresponding FoodEx2 codes. The other challenge arose from discrepancies between the classification of foods in the national database and in the FoodEx2 system regarding some of the recipes/mixed food groups that had to be broken down into ingredients. While working on these issues, the Fellow had the opportunity to learn about the structure and distinct features of the output data from GloboDiet<sup>®</sup> (IARC, Lyon, France), the software used for collecting food consumption data in the Netherlands. The mapping and data cleaning process were finalised by the team on time and the data submitted to EFSA.

### 2.2.2. Preparing the scientific report for DNFCS

The food consumption data collected as part of the EU Menu survey must be complemented with a scientific report describing the methodology used and its compliance with the EFSA guidance published in 2009. The Fellow prepared the first version of the report, presented it during a team meeting, and was engaged in discussions concerning adaptations and additions needed. The Fellow was actively involved in the reviewing and refining process leading to the final version of the report. While preparing the final report on the DNFCS for EFSA, the Fellow was able to use her previous knowledge from the Estonian food consumption survey and also to gain a detailed insight into how these surveys are carried out in the Netherlands. The Fellow had the opportunity to evaluate the adaptations made to the methodology proposed by the EFSA guidance for data collection in national dietary surveys and to learn about the challenges faced in the Dutch survey as well as potential ways of coping with them in the future. For that purpose, the Fellow also provided a detailed comparison of EFSA guidance documents from 2009 and 2014 on topics relevant to the methodology used in Dutch food consumption surveys. The scientific report was provided to EFSA together with the food consumption data as scheduled in the initial time frame.

### 2.2.3. Calculating the habitual nutrient intake

To learn about the principles of habitual intake modelling for populations and the use of the SPADE model in R, the Fellow attended a 2.5-day course organised in Wageningen by the VLAG Graduate School. As input to the SPADE model, the Fellow prepared the necessary datasets including files with dietary reference values from EFSA as well as from the Dutch Health Council (Scientific Committee on Food and EFSA Scientific Panel on Dietetic Products, Nutrition and Allergies, 2006; Gezondheidsraad, 2014; EFSA, 2017). The Fellow also tested the new version of SPADE that allows the model to be run simultaneously for different age classes and various sets of dietary reference values and provides the habitual intake of multiple subgroups of the population. Using the new SPADE, the Fellow carried out statistical analyses to calculate the habitual intake of nutrients from foods based on the latest Dutch food consumption survey and estimate the proportion of the population below or above a certain cut-off value for each nutrient. After submitting this progress report, more analyses of habitual nutrient intake will be performed to estimate the intake of nutrients from different sources (foods and dietary supplements), followed by calculations of the confidence intervals for distributions with a parametric

bootstrap. These data are necessary for the interpretation of the results. The Fellow will also be included in activities related to disseminating the results of the survey including preparing the national reports and creating a website to present the results to the public.

#### 2.2.4. Other activities

Given the availability of new technologies like apps and scanners to identify barcodes on foods, it is worthwhile to further investigate less labour-intensive alternatives for collecting food consumption data while continuing to maintain the level of detail and harmonisation across Europe. For this reason, the Fellow performed a literature search of validity and usability studies on mobile applications used for recording food intake. The aim was to identify the features supported by these applications, the methods used to validate them and the main outcomes of these validation and usability studies. The Fellow gave a presentation on her findings to colleagues working on developing a mobile application for future Dutch food consumption surveys.

A high sugar intake has become a subject of scientific debate because of the potential health implications, free sugar recommendations by the WHO and the upcoming assessment of dietary sugars by EFSA (WHO, 2015; EFSA, 2018). RIVM has been requested by the Dutch Ministry of Health, Welfare and Sport to calculate the habitual intake of added and free sugars based on the data from DNFCs. The Fellow made an overview of the different concepts used to describe intake of dietary sugars as well as methods applied to calculate the amount of both free and added sugars in foods. During the last 4 months of the programme, the Fellow is expected to link the DNFCs data with the estimated values of free and added sugar and use SPADE to calculate the habitual intake of the Dutch population. Based on these results, it is possible to evaluate the adherence to the guidelines set by WHO and other relevant authorities as well as to look for trends in free sugar consumption in the Netherlands based on the previous survey by Sluik et al. (2016).

### 3. Conclusions

The main focus of the work programme proposed by the RIVM to the EU-FORA Fellow was on the preparation of the Dutch food consumption data for risk assessment. The activities of the Fellow proceeded in accordance with the work programme and the expected time frame.

The Fellow contributed to the FoodEx2 mapping of the Dutch food consumption data and to write the final scientific report for EFSA as well as to the preparation of the national reports by analysing, for example, the habitual intake of nutrients using the SPADE programme and comparing these results with the dietary reference values. During this work, the Fellow had the opportunity to provide input on practices used in her home institute. Besides the activities described in the initial working programme, the Fellow was assigned additional tasks such as performing a literature search of validity and usability studies of mobile applications developed for collecting food consumption data and exploring methods for estimating added-sugar/free-sugar intake. After submitting this progress report, the analyses of habitual nutrient intake will continue with estimating the nutrient intake from supplements and calculating confidence intervals for distributions obtained by a parametric bootstrap. The Fellow will also be included in activities related to disseminating the results of the survey. During the last months of the EU-FORA year, the Fellow is expected to link the DNFCs data with the estimated values of free and added sugar and calculate the habitual intake of the Dutch population.

The proposed working programme was an excellent fit with the experience and expectations of the Fellow and provided the opportunity for her to get acquainted with the different facets of risk assessment work performed at the RIVM. Throughout the year, the Fellow received sufficient supervision and support from her supervisor and other team members responsible for specific tasks. She was invited to join all social and topic-specific activities of the team, experts, department and centre. Besides gaining valuable insight into topics directly related to the Fellow's work at her home institute, she was able to share her experiences and contribute to the workflow of the hosting site. As a result, the EU-FORA programme provided a great environment for mutual learning and created a strong basis for future scientific collaboration.

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## Glossary and Abbreviations

DNFCS	Dutch National Food Consumption Survey
EPIC-SOFT	Dietary software created by International Agency for Research on Cancer
EU Menu	Fully harmonised pan-European Food Consumption Survey called 'What's on the Menu in Europe?'
EU-FORA	The European FOod Risk Assessment Fellowship Programme
FoodEx2	Version 2 of the EFSA Food classification and description system for exposure assessment
GloboDiet	Computer-directed interview program GloboDiet <sup>©</sup> (former EPIC-soft <sup>©</sup> ) provided by the International Agency for Research on Cancer (IARC, Lyon, France). With the GloboDiet program, the 24-hour recalls are standardised, and the answers can be entered directly into the computer.
IARC	International Agency for Research on Cancer
RIVM	Dutch Institute of Public Health and the Environment
SPADE	Statistical Program to Assess Dietary Exposure developed by RIVM
WHO	World Health Organization